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Dear Sir,

I have forwarded to you
this morning my thesis on 'Scurvy
in Children', which I beg to submit
to the Senatus of the University of
Edinburgh for the degree of M.D.

I remain,

Yours faithfully,

Geo. A. Sutherland.

Prof. T. R. Fraser

Dean of the Faculty of Medicine

SCURVY IN CHILDREN

by

G. A. Sutherland.

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PLAN OF THE THESIS.

In this paper I have first of all given a general sketch of scurvy as it is manifested in children, and have compared and contrasted the symptoms with those present in adults. The more recent researches into the pathology, and pathological anatomy, are specially referred to, as these have not yet been incorporated into the textbooks.

In the second part, I have recorded at length seven cases which present features of special interest, and in most of which a post-mortem examination was made.

The numbered references throughout the paper correspond with the bibliography at the end. I have added an appendix of published cases in brief. These have been selected to illustrate the general features of the disease as they have been described in the paper.

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PART I.

DEFINITION.

"Scurvy or Scorbutus is a peculiar state of malnutrition, supervening gradually upon the continued use of a dietary deficient in fresh vegetable material and tending to death, after a longer or shorter interval, if the circumstances under which it arose remain unaltered. The condition is essentially marked by a dull leaden pallor of complexion; excessive bodily debility and mental lethargy; dyspnoea upon slight exertion, unaccounted for by the auscultatory signs; spontaneous effusions of blood coloured fluid into the various tissues of the body, causing petechiæ and bruise like patches to appear on its surface; together with (commonly) a livid, swollen, and spongy state of the gums, and a disposition for them to bleed upon the slightest irritation."

(Dr. Thomas Buzzard in Reynolds System of Medicine).

I. HISTORY.

Scurvy is a disease which for centuries was extremely fatal to large numbers of men, both at sea and on land, but was finally practically extinguished, except as regards occasional sporadic cases, by the discovery that its appearance was prevented, and its cure rapidly effected, by the administration of a sufficient and regular quantity of fresh fruits and vegetables. Amongst the voluminous writings on this subject, by classical authors, few references are to be found to the occurrence of scurvy amongst children. In the latter half of the present century, the attention of German workers was directed to a curious series of symptoms which appeared in connection with rickets, and in default of a better name, and a more correct pathology, they termed these cases "Acute Rickets". Under this title, cases were published by Möller (1859), Bohn (1868), Forster (1868), Hirschsprung (1872), and others.

The subject did not attract any attention in this country until in 1878, Dr. W. B. Cheadle published in the Lancet a paper on "Three cases of Scurvy supervening on Rickets in young children." These patients presented symptoms which Dr. Cheadle

recognised as clearly scorbutic and not rachitic, namely, swollen and spongy gums, cachexia and anaemia, swollen and tender limbs, and extravasations of blood. He discovered that the diet was chiefly of a farinaceous type, with an almost entire absence of milk and a complete absence of any fresh vegetable food. The diagnosis was made absolutely certain by the rapid recovery of the patients under the administration of fresh milk, oranges, and potatoes. Attention was then drawn to certain symptoms of bone or periosteal disease occurring in children, and which were of an unusual character. In 1881, Dr. Samuel Gee published some cases of this nature under the title "Osteal or Periosteal Cachexia", and this was followed by another paper from Dr. Cheadle in 1882, "Osteal or Periosteal Cachexia and Scurvy", in which he shewed clearly that the chief factor in the production of the manifestations described was scurvy. Finally in 1883, Dr. Thomas Barlow contributed an account of several post mortem examinations he had made in fatal cases, and proved conclusively from the appearances found that the cases described as acute rickets were in reality a combination of rickets and scurvy, "the scurvy being an essential, and the rickets a variable element".

Since then the disease has been noticed in most

textbooks bearing on diseases of children, and additional cases have been described in the journals. Amongst English writers of authority, the only ones I find who do not accept the conclusions of Dr. Cheadle and Dr. Barlow, are Dr. Ashby and Mr. Wright. In their well known work on "Diseases of Children" they incline to the view that the condition described "is rather^{an} exaggerated or excessive form of the anaemia which is usually present in severe rickets", thus returning to the opinion of the earlier German writers. In Germany, the correctness of the views published by Drs. Cheadle and Barlow has been acknowledged by Dr. Rehn and others, and additional evidence has been supplied in recorded cases. In France the disease does not seem to have attracted much attention. In America, Dr. Northrup of New York has published an account of ten cases, but considers the disease to be of extremely rare occurrence in that country.

II. ETIOLOGY.

Scurvy in children is essentially a food disorder, being always associated with a deficient supply of sound fresh animal or vegetable products, and the employment of a diet of preserved or artificially

prepared foods. In many cases also, the food employed has been quite unsuited to an infant's digestive powers, and therefore useless as nourishment.

In regard to the scurvy of adults, the question as to the etiology was settled by the results of treatment, and the same method has to be adopted in the case of children. Dr. Buzzard (40) says "Scurvy does not occur when the supply of wholesome and fresh vegetables has been abundant, even although the food generally may not be adequate to perfect nutrition. Scurvy only occurs when fresh vegetable nutriment has been for some time partially or completely withheld". What the exact constituent is which gives to fresh vegetables their antiscorbutic property has not been definitely ascertained. In 1848 Dr. Garrod propounded the view that the cause of scurvy was the absence from the food of a requisite amount of potash, but this theory has not stood the test of experience. Dr. Baly considered that the essential constituents were the organic acids, such as malic, citric, and tartaric acids. Later Dr, Buzzard suggested that neither the organic acids, nor the potash alone, but the combination of the two constituted the essential element. Dr. Ralfe (38) further investigated the subject and concluded that the primary change in scurvy was a diminution of the alkalinity of the blood due to a general alteration between the various acids, inorganic as well as organic, and

the bases found in the blood.

Clinical experience shows that nothing is so good in the treatment of scurvy as the fresh vegetables themselves. In the case of children the food materials usually ordered have been three in number, namely (i) Fresh vegetables, such as potatoes, and the juice of ripe fruits, (ii) Fresh cow's milk, (iii) Fresh ~~raw~~ meat juice; and it has been held that the occurrence of scurvy has been due to the absence of these from the diet.

In considering this question, the effects of cooking must be referred to. Dr. Budd (42) says, "It appears that the antiscorbutic virtue of vegetables is greatest when they are taken raw. Herbs in the form of salads are more efficacious than when boiled or any way prepared by heat; and their antiscorbutic properties are entirely destroyed by drying".

Potatoes are, of course, always boiled, and it may be taken as proved that scurvy will not develop when a sufficiency of boiled potatoes forms part of the regular diet. Cow's milk is frequently either scalded or boiled, and it is possible that certain chemical processes may take place, for instance a change of alkaline into acid salts, which diminish

the antiscorbutic properties. The same remark applies in the case of meat ^{*although in the treatment of the disease it is the raw juice of the meat*} which has been specially recommended.

It may be admitted then, that there is a certain lowering of the antiscorbutic value of foods by

cooking, but the effect is not of such importance as to be considered an etiological factor in scurvy.

As regards clinical experience, cases have been recorded in which scurvy supervened when either fresh meat or fresh cow's milk entered into the diet to an extent that would usually be counted sufficient to ward off the disease. Taking first the subject of meat juice, we find that both Dr. Cheadle and Dr. Barlow recommend its use and regard it as a powerful anti-scorbutic. In his remarks on a series of cases of scurvy, Dr. Barlow (4) says, "It is very important to ascertain whether the affection ever appears whilst a child is taking raw meat juice. It is clear that the use of beef tea was not adequate to prevent the appearance of the disease, for in three cases, perhaps four, this food was being given at the time of onset". Dr. W. E. Green (25) has recorded a very well marked case of scurvy in an infant of twelve months, for which he gave half a wine glassful of the juice of raw meat every day, and during its administration the gums got steadily worse, and swelling of the extremities came on. This infant rapidly recovered under the administration of grape juice. A case of very great interest is described by Dr. Northrup (27) of the supervention of scurvy on an exclusive meat diet. A child of three years, suffering from diarrhoea, was put on meat diet and the parents finding

the food agree, continued it long after the original complaint had ceased. Some months later the child had well marked scurvy, from which it recovered under rational diet. The question as to the value of meat as a prevention of scurvy in adults has been much discussed. Writing on this subject Dr. Ralfe(37) says, "how is it that tropical and arctic experience is at variance with that acquired in Europe. The only explanation that occurs to me is the different circumstances under which meat is eaten. As is well known, the reaction of freshly killed meat is alkaline, from the presence of neutral sodium phosphate; after rigor mortis has passed off it gradually becomes acid owing to the formation of lactic acid. Now in hot climates meat has to be eaten so freshly killed that no time is allowed for the development of lactic acid; in arctic regions the freezing arrests its formation. The muscle plasma therefore remains alkaline. In Europe meat is invariably hung, lactic acid is developed freely, and the muscle plasma is consequently acid". Hence he concludes that meat freshly killed, or immediately frozen is antiscorbutic, but when kept as in this country it is not so. Dr. Budd (42) is very emphatic in regard to this question. He says, "the opinion that scurvy can be prevented, or cured by fresh meat, is however still held by persons, by whom it is of the utmost importance that correct

notions on this head should be entertained. We have known the most fatal effects result from the erroneous opinions of captains of merchant vessels on this point". My own experience has led me to give meat juice a secondary place amongst antiscorbutics, after the disease has developed, and at the same time to conclude that scurvy is quite likely to supervene amongst children in cases where the only antiscorbutic present in the diet is fresh meat.

As regards milk, it is reckoned a complete food for infants, but cases of scurvy have arisen when it formed a part of the diet. Are we then to conclude that fresh cow's milk is not antiscorbutic? Dr. Budd(42) says, "we have no evidence shewing that milk is antiscorbutic". Dr. Ambrose Charpentier (15) is of opinion that it is not, from his experience in two cases. The evidence he adduces is not very conclusive, for his first patient, aged nine months, had had cow's milk for three months, and then condensed milk with a patent starchy food for the following six months, after which scurvy supervened. The diet of his second patient consisted of "fresh milk, and beef tea, with minced meat occasionally" and if these were of good quality and sufficient quantity, the occurrence of the disease is certainly very unusual, but the age of the patient, sixteen years, removes the case from consideration at present. On the

other hand the evidence in favour of the benefit from cow's milk in the treatment of scurvy is overwhelming. The explanation of the onset of scurvy under milk diet may probably be found in the impaired quality of the milk. This will prevail especially in cities and large towns, where most cases of the disease are found. If the cow is stall fed, on a diet of oil cake, hay, and other preserved or dried foods, the milk will probably be of inferior antiscorbutic quality. Again, amongst the poor, the use of dirty feeding bottles is a frequent cause of the milk turning sour, and this lactic acid fermentation has the effect of diminishing or destroying the antiscorbutic property of milk, as of meat; or the milk may have been adulterated with water, chalk etc.; or the child's digestive system may be so impaired that a large part of the milk passes through the intestines unchanged.

There is no doubt that the appearance of scurvy amongst children during the past fifteen years has been largely due due to the substitution of proprietary infant's foods, preserved, condensed, and artificially prepared, for cow's milk and natural vegetable products. The reason why the disease is not more common is that children usually have from an early age some . potato and gravy, or fruit given, and thus the anti-scorbutic material is supplied (Cheadle) .

Dr. Northrup has noted that London is specially

characterised by the number of cases of infantile scurvy, and also by the enormous sale of proprietary foods for children.

The influence of unhealthy surroundings.

This may be excluded as a factor of importance in the production of scurvy. Many of the most marked cases have occurred in the houses of well-to-do people, where the hygienic arrangements were as perfect as possible. On the other hand the progress of the disease in a child living in an unhealthy house will certainly be more rapid than if there was plenty of fresh air and water to be had.

The season of the year.

In the treatises on scurvy in adults, mention is made of the fact that the severity of an epidemic was usually most marked during the winter, and that improvement set in with the onset of spring. Thus, Dr. Grainger, writing to Dr. Lind (39) on an outbreak of scurvy in a regiment at Fortwilliam in 1750, says, "The scurvy began in March, raged in April, declined in May, and left us before the middle of June". In some cases the administration of antiscorbutics during the winter has been insufficient to relieve the symptoms, and a cure did not set in until the patients were able to obtain fresh spring vegetables.

Amongst twenty-eight cases of scurvy in children, Dr. Barlow found that seventeen occurred in the colder six months, and eleven in the warmer six months of the year. Out of forty-eight cases I have collected, in which the exact month is mentioned, the following is the distribution.

| | | | |
|----------|----|-----------|---|
| January | 6 | June | 2 |
| February | 3 | July | 3 |
| March | 5 | August | 2 |
| April | 9 | September | 2 |
| May | 6 | | |
| October | 5 | Total | 9 |
| November | 3 | | |
| December | 2 | | |
| <hr/> | | | |
| Total | 39 | | |
| <hr/> | | | |

From this list, which is, of course, too limited for a thorough generalisation, it may also be said that amongst children scurvy "raged in April". It is probable that in addition to the effects of the milder spring weather, the fact that vegetables and fruits are becoming plentiful has a bearing on the diminished number of cases during the summer months. This is shewn in the table, where the four months of the fruit season supply only nine cases, while the eight months

during which fruit is not so common, shew thirty-nine cases.

Further light is thrown on this subject by an examination of cases of recurrent scurvy in children, of which I give two examples.

The first case was published by Dr. T. Colcott Fox in the Path: Soc: Trans: for 1890, and the diagnosis of scurvy had been confirmed on post mortem examination.

- (1) In the winter of 1884, the patient, (aet. 8 years), had an illness called "acute rheumatism".
- (2) In October 1885, (aet. 9 years), he was admitted to hospital for 'hip joint disease'. This was not confirmed on examination, and he was discharged in March 1886.
- (3) In February, 1887, (aet. 10 years), he was re-admitted with atrophy of the bones of the lower extremity. He had been ailing since the previous Christmas. Discharged in May 1887.
- (4) In February, 1888, (aet. 11 years), he was re-admitted with weakness and pains in the lower limbs. This illness had lasted since the previous Christmas. Discharged in March 1888.
- (5) In April, 1889, (aet. 12 years), he was re-admitted with symptoms of acute scurvy, and

discharged in Nov. 1889.

- (6) In March 1890, (aet. 13 years), he was readmitted in a similar condition, and died on April 5th.

This patient always improved under hospital diet, although he was not put on special antiscorbutic treatment; was fairly well during the summer months, and relapsed in the winter.

Mr. Thomas Smith's case, related by Dr. Barlow, (4) is also instructive.

- (1) In April, 1874, the patient, aged 13 months, was seized with great tenderness in the lower limbs, the feet, legs, and thighs becoming at the same time very swollen. This continued for two months, and then there was slow improvement, so that by summer she was considered well. There was no treatment.

- (2) At Xmas, 1874, aet. 20 months, the child had another attack of swelling in the lower limbs, with great tenderness. She continued in this condition until the 26th. February 1875, when she was admitted to hospital, and died on March 4th.

These cases shew that the conclusions of Dr. Budd and others as to the period of the year in which scurvy is most prevalent amongst adults, hold good

also in the case of children.

Influence of Rickets.

In many cases the symptoms of rickets are present along with the scorbutic manifestations, and this led German writers to imagine that they were dealing with some new form of the disease, which they termed 'acute rickets'. The diseases are, however, quite distinct as regards the etiology and the progress. Both may be considered as food disorders, but in the one it is the antiscorbutic material which is deficient, and in the other, the antirachitic.

Age and Sex.

These are not important etiological factors in the production of scurvy, nevertheless the overwhelming proportion of cases occurring during the first two years of life is very striking. Dr. Barlow has met with one case at five months, and quotes another of Senator's at four months. These are exceptional, for even under a diet from which the antiscorbutic element is entirely excluded, the disease does not usually appear for some months. I have never met with a case of scurvy amongst infants who were entirely breast fed, and probably the disease never arises under those circumstances, unless the mother is herself suffering from scurvy at the time. The period of life.

between the seventh and twenty-fourth months supplies by far the greatest number of cases, as shewn in the accompanying table. As this is also the period during which artificial and preserved infants' foods are chiefly used, the circumstance is not surprising. After two years of age, the children of the poor have the same food as their parents, and as this usually includes potatoes, the necessary antiscorbutic element is supplied, and scurvy is averted. Amongst children over two years of age who are the subjects of scurvy, enquiry will usually elicit the fact that they have a positive dislike to fruit and vegetables.

Table of cases arranged according to age.

| | | | |
|------------------|---|---|----|
| Under 6 months | . | . | 2 |
| 6th - 12th month | . | . | 27 |
| 1st - 2nd year | . | . | 28 |
| 2nd - 3rd " | . | . | 5 |
| 3rd - 4th " | . | . | 2 |
| 4th - 5th " | . | . | 2 |
| 5th - 6th " | . | . | 1 |
| 6th - 7th " | . | . | 1 |
| 7th - 8th " | . | . | 1 |
| 8th - 9th " | . | . | 0 |
| 9th - 10th " | . | . | 1 |
| 10th - 11th " | . | . | 0 |
| 11th - 12th " | . | . | 1 |

| | |
|-------|----------------|
| Total | <hr/> 71 <hr/> |
|-------|----------------|

III. SIGNS AND SYMPTOMS.

Scurvy is a chronic disease in which the premonitory symptoms usually pass unrecognised. It is further associated in most cases in children with rickets, the signs of which are more evident, and consequently the scorbutic manifestations are overlooked until the onset of haemorrhage, or excessive tenderness in the limbs excites suspicion. At the onset, a gradually increasing listlessness with debility comes over the child; instead of running about actively, he will prefer to sit still, or lie down; or, if an infant, the patient will show none of the excessive motor activity in the limbs, which is characteristic of that period of life. As the disease advances, the signs of anaemia increase; the child becomes short of breath on exertion, and the complexion assumes a yellowish hue, with pallor of the lips and conjunctivae, and of the skin surfaces. The listlessness increases to complete apathy, the patient taking no notice of what is going on around, refusing to join in the play of other children, and being fretful and irritable if disturbed. This is the condition known as "scorbutic cachexia", and from it alone the disease can often be easily recognised. Finally, and it may be suddenly, there comes complete loss of motor power in the lower limbs; the child screams if he is moved or touched,

and may lie moaning even when undisturbed; and the fear of being touched may be so excessive that he cries out when any one approaches him. This last symptom points to an amount of suffering to which there are very few parallels in childhood. Following on, or accompanying the above, are other symptoms which are best considered in relation to the localities which they affect.

1. The Gums. In the early stages of scurvy the gums are characterised by a pallor which is due to the anaemia present. Later swelling and redness come on at the edge of the teeth, which increase until there may be large protuberant masses of gum tissue, purplish in colour, and entirely concealing the teeth. The swollen tissue is apt to ulcerate, and break down, and more or less severe haemorrhage may take place. When ulceration has occurred, the breath becomes intensely foetid. These are the conditions when the gum symptoms are excessive, and are well known from the descriptions of writers on adult scurvy. In many cases, however, in children the gum symptoms are slight or entirely absent. In infants who have not cut any teeth there is ^{frequently} not found any swelling of the gums, the usual morbid change, if any is present, being a few minute haemorrhagic spots in the deeper layers of the mucous membrane over the front of the

gums. The origin of the gum affection is not to be traced to any special liability in the mucous membrane of the gums, but to the presence of dental tissue. In adults who have lost their teeth it has been noted that swelling of the gums was absent, even when the other signs of scurvy were well marked. There is a difference, however, in infancy, for the teeth are present although they have not erupted, and it would naturally be expected that haemorrhage and swelling would occur around them, from the excessive vascular supply their growth demands (V.P. under Pathology) But another factor comes into play here, namely the presence of rickets, which has probably existed longer than the scorbutic affection, and consequently the growth of the teeth has been practically stopped. To this cause may be ascribed the total absence of gum symptoms in many cases of infants who have not cut any teeth, and the slightness of the symptoms in many who have. In those patients in whom a few teeth are cut the whole gum may be red or purple, and swollen, but the condition is usually most marked around the teeth which have erupted, while the posterior parts over the oncoming teeth are never ulcerated and bleeding. The reason of this is, I think, that there is always a considerable septic element present around teeth, and the organisms present find a suitable medium for development in the swollen and spongy and vascular

tissue, with the result that the tissues become ulcerated, bleed, and cause a most offensive odour. Dr. Cheadle (1) refers to the possibility that some cases of ulcerative stomatitis in childhood are to be traced to a scorbutic cause, and I have seen some examples which strongly support this view.

2. The Bones. I have already referred to the loss of power and tenderness in the lower limbs as a marked symptom of scorbutic disease in children, and in the case of infants it may be described as the most marked and most frequent symptom. While the same conditions exist to a less extent in other parts of the body, the phenomena present in the lower limbs are of very great value in forming a correct diagnosis, and may be classified as follows:

- (i) Oedema, commencing in the feet and ankles, and extending up the legs.
- (ii) Swelling, tenderness, and loss of power from extravasation of blood or serum into the muscles and sheaths of tendons, or between the muscles or tendons.
- (iii) Swelling, tenderness, and loss of power from haemorrhagic effusion under the periosteum.

The last of these conditions will now be considered.

The thigh is most commonly and most early affected.

It will be observed that the child cries out when the limb is moved, and that a swelling has developed rather suddenly over one or other extremity of the femur. This will increase, and the child by its shrill piercing screams will shew clearly that intense pain is present. The skin of the thigh is tense and glistening, but does not usually pit on pressure, nor is it inflamed. The extreme pain is due to the tension present under the separated periosteum. In more advanced cases separation of the epiphyses takes place resulting in complete loss of motor power, and distinct crepitus can then be elicited between the shaft and the epiphysis. The onset is often sudden, and the absorption of the effusion and diminution of the swelling under treatment is also strikingly rapid. In advanced cases fracture of the shaft of the bone is not uncommon, especially if it is roughly handled, or if the child is using the limb. The swelling is usually present on both sides, but may be greater on one side than on the other. The bones of the legs, and of the upper and forearms, may also be similarly affected, and more rarely haemorrhagic effusion takes place in connection with the skull, the iliac bones, or the scapulae. As regards the ribs, the separation of the ribs and their cartilages has led to a distinct recession of the sternum, which was most marked on inspiration (Gee)

3. The Eyes. A common sign of scurvy, and one of considerable diagnostic importance, is oedema of the eyelids. This may be present in one or both eyes, and affects chiefly the upper eyelid. In more severe cases the eyes will be completely closed owing to the amount of swelling present, and this is usually accompanied by actual haemorrhage, so that the eyelid is at first red, then black, and then yellow, as the effused blood undergoes absorption. Bleeding also takes place into the conjunctiva which becomes puffy and swollen. I have not seen any case of retinal haemorrhage in this disease, nor have I met with any in the literature of the subject. Dr. Suckling, referring to his experience of scurvy amongst adults says, "retinal haemorrhages are present in nearly all cases". Proptosis has been noted by some writers, and this depends according to Dr. Barlow (5) on a bone lesion, namely, "extravasation of blood between the orbital plate of the frontal and its subjacent periosteum, this extravasation tending to push down the eyeball." Dr. Holmes Spicer (18) has recorded three cases of scurvy in infants in which the leading symptom was proptosis with oedema of the upper eyelids, and he agrees with Dr. Barlow in regarding the condition as due to subperiosteal haemorrhage. Dr. Spicer has noted that the immediate cause is frequently a violent fit of crying. Both eyes may be found displaced down-

wards and forwards, or one eye only may be affected at first, and the other subsequently. In some cases a slight subperiosteal haemorrhage may be detected from a line of blood staining along the orbital margin. The absorption of the effused blood under proper treatment proceeds rapidly at first, but a certain amount of thickening with displacement of the eye, may persist for months. In the recent stage of the haemorrhage, pressure on the eyeball causes acute pain, just as in the case of subperiosteal effusions elsewhere.

4. The Urine. Dr Gee (10) and Dr. J. Thomson (16) have recorded cases in which haemorrhage from the kidneys was the only sign of scurvy in infants. My own experience is that blood is frequently present in the urine in this disease, although, as a rule, it is not excessive in amount. The source of the haemorrhage is the kidneys, and blood casts may be present in the urine. As regards adults, the condition seems to be exceptional, for Dr. Budd (42) says "It is worthy of remark that notwithstanding the great tendency to haemorrhage in scurvy, we have never met with an instance in which blood was observed in the urine; and in more than twenty cases of scurvy we have tested the urine by heat and nitric acid without finding it albuminous in a single instance". In the case of

children albuminuria is not uncommon, but casts are not usually present, or are few in number. I have several times noted an excess of oxalates or uric acid crystals, but as this condition is common to all anaemic affections, it is not of much importance. Dr. Ralfe (38) has made a careful examination of the urine in cases of scurvy amongst adults, and finds that the excretion of uric acid is usually doubled in amount.

5. The Skin and Subcutaneous Tissue. The skin is frequently dry and harsh.

Oedema is a common and often an early condition present. We have already referred to its occurrence in the eyelids, and the other most frequent situation is around the ankles, and on the dorsum of the feet. In more severe cases the hands also are affected, and it may extend up the limbs, and be present on the trunk.

Subcutaneous haemorrhages are frequently met with in scurvy, as in all forms of anaemia, and while they may be extremely minute in some cases, the more characteristic forms are of larger size, having a bruise like appearance, or even causing large extravasations which can be seen and felt. The occurrence of these into the scalp is of considerable diagnostic importance in scurvy. A trifling injury will often

produce a considerable effusion of blood into the subcutaneous tissues.

Ulceration of the skin has been noted in several cases. This usually commences as a bleb, which becomes haemorrhagic, bursts, and leaves an ulcerated surface beneath. This ulcer tends to spread into the deeper tissues, and to enlarge at the circumference. It is not painful, but presents a dirty sloughing surface and bleeds readily. The ulcers may occur spontaneously, or may follow an injury.

6. The Muscles. Muscular weakness and so called 'rheumatic pains' are frequently complained of by the subjects of scurvy. The cause of these is an extravasation of blood or serum between and into the muscles, which also produces the brawny feel of the limbs in this disease. The limbs are usually kept flexed so as to relieve as much as possible the tension caused by these effusions. In more chronic cases, a condition of contraction is established, so that the knees may be firmly flexed, or the foot may assume the position of "pes equinus".

These are the most frequent signs of scurvy, but there are many others which are not so often seen. As regards the leading sign, viz. haemorrhage, it may occur from many other regions besides those des-

cribed. Epistaxis is not uncommon. There may be bleeding from the bowel, or from the stomach, or from the lung. The serous cavities, and more especially the pleura, may be more or less filled with fibrinous or bloody effusion. Another symptom of great importance, because of the fatal result which may follow, is a tendency to cardiac syncope.

Minor attacks of this nature are not uncommon, and I have seen one case which terminated fatally from this cause (Case III). The order in which the symptoms appear cannot be laid down with any certainty. The onset of haemorrhage is usually sudden and may be extensive, and attacks recur at irregular intervals. The child is found in the morning to have a crop of subcutaneous haemorrhages, or a large subperiosteal effusion is found in one thigh. Scurvy is not a febrile disease, but when the pain is very severe, as for example with great periosteal or muscular tension from effusion, the temperature is usually raised to 100° or 101°. If the temperature is higher than this, the physician ought to look out for some complication, such as bronchitis or pneumonia. Diarrhoea, with offensive motions, is sometimes present, but as this condition is common to rickets also, it cannot be described as essentially scorbutic. The appetite usually remains good until the cachexia is well marked, and then it falls off. The special

liking that scorbutic infants have for fruits and vegetables, and the voracious manner in which they devour them, are frequently very striking. In other cases there will be found a positive dislike and aversion to these substances.

COMPLICATIONS.

The very frequent association of rickets with scurvy has been referred to and will be further discussed in considering the differential diagnosis.

The most common, and the most important of the complications, is pneumonia. It might be held that this also was due to the accompanying rickets, were it not for the fact that a similar tendency is present in adults who are suffering from scurvy. The pneumonia may be of the lobar, or of the catarrhal type, and is usually extremely severe so that recovery is exceptional. Examples will be found in the accompanying list of illustrative cases.

IV. PATHOLOGY AND MORBID ANATOMY.

There is not much information to be gathered on the pathology of Scurvy from the classical text-books on the disease, nor has any theory even yet been definitely accepted. We shall refer to some of the more recent writings on the subject, with a view to their bearing on the symptoms of scurvy in children.

Dr. Ralfe's theory that "the primary change is a chemical alteration in the blood consisting essentially in a diminution of its alkalinity" has been already referred to. The result of this is a dissolution of the blood corpuscles, and fatty degeneration of the muscles, and of the secreting cells of the liver and kidney. The change will also affect the walls of the blood vessels which become fragile and easily rupture, and the mucous membrane of the gums, which swells and softens. Dr. N. Uskow (34) Superintendent of the Marine Hospital, Cronstadt, has directed attention specially to the minute anatomy of the gums, where changes are usually present. He finds that the alteration "begins in the deeper layers, and consists in the development of obstruction in the blood vessels, and one of the consequences of this obstruction is the stasis in the papillae, the vessels of which are so distended that of the proper structure of the papillae only the epithelium may be

visible." The endothelium of the blood vessels is swollen, and the lumen is plugged, sometimes with red corpuscles, sometimes with white, rarely with both. Later on there occurs an extravasation of red corpuscles, which become transformed into brown translucent granular pigment. Rupture of vessels could never be seen. When the disease is intense, the papillae of the gum become gangrenous and break down. The morbid process may involve the deep layers of the periosteum, between which, and the bone are found some traces of extravasation and caries. A similar vascular change may be seen, although rarely, in the periosteum of the anterior extremity of the ribs, and in very severe cases the ribs may be attacked by osteitis rarefaciens. Later the connection of the ribs and their cartilages may be altered and disturbed. The marrow of the ribs, as well as of the other long bones is red, and on microscopic examination, is found to consist of red cells, and a few fat cells and pigment. As regards the blood, he did not find that the number of corpuscles was abnormal in any way.

Dr. T. Stazevich (33) has made a careful examination of the tissues in scurvy, and finds in all cases an extensive degeneration of all the organs, and especially of the voluntary muscular tissue, which contained scarcely any really normal fasciculi. The blood vessels were not greatly altered. He does not

consider the petechial rash as due to capillary extravasation, but looks upon the spots as local haemorrhagic inflammations. In the blood a large number of stellate corpuscles were found. The conclusion come to is that the disease is a form of septic poisoning.

Dr. W. Koch (35) has published some views on scurvy which are very far removed from those commonly accepted and, as Professor Gairdner has pointed out, rather carry us back to the opinions of the middle ages. He includes scurvy, and all other forms of the "haemorrhagic diathesis", amongst infective diseases, the etiology of which is to be found in the action of pathogenic organisms. He has himself failed so far to isolate any such organism from scorbutic blood or tissues.

More recently, however, Dr. Freiere (36) has discovered and cultivated micro-cocci which he believes to be the parasites of scurvy. He had three patients suffering from scorbutus, and from blood drawn from the gums he made a cultivation in beef gelatine. At the end of fifteen days the gelatine was quite liquefied, and there were numerous colonies of minute micrococci, each surrounded by a soft transparent material.

As regards the examination of the blood in scurvy, Dr. Buzzard remarks that the only positive modification that can be detected is a very considerable diminution

in its density. On microscopic examination I have never found any changes other than those present in simple anaemia.

The Morbid Anatomy of scurvy has been referred to by the older writers, and the following extracts are made for comparison with the post mortem appearances in children. Dr. Lind in his treatise on Scurvy has noted the following among other changes:-

"No. 6. All they who died suddenly, without any visible cause of their death, had the auricles of their heart as big as one's fist, and full of coagulated blood.

No. 15. In some, when moved, we heard a small grating of the bones. Upon opening these bodies, the epiphyses were found entirely separated from the bones; which by rubbing against each other occasioned this noise. In some we perceived a small low noise when they breathed. In those the cartilages of the sternum were found separated from the bony part of the ribs.

No. 17. There were some dead bodies, in which, if we squeezed betwixt two fingers the end of the ribs which began to be separated from the cartilages, there came abundance of corrupted matter. This was the spongy part of the bone: so that, after squeezing, there remained nothing of the rib but the two bony plates.

No. 19. All the young persons under eighteen had in some degree their epiphyses separated from the body of the bone: this water having penetrated into the very substance of it.

No. 21. What was very surprising, the brains of these poor creatures were always sound and entire, and they preserved their appetite to the last."

Dr. Budd, writing in 1840, comments on the fact that very little is known of the morbid anatomy of scurvy, which he explains by the fact that deaths had usually occurred at sea, where no post mortem examinations are ~~usually~~ held. He had himself made only three autopsies, but notes some interesting points. In one case, that of a patient aged 25 years, he found Peyer's patches dotted with black points, and blackish spots on the jejunum, due to extravasated blood. The heart contained numerous white clots extending into the larger vessels. The lungs were oedematous. "On the left tibia there was a node like swelling which had attracted our attention during the lifetime of the patient. This leg was injected with size before it was examined: the injection was very successful, the fluid employed returning by the veins, and imparting a vermilion colour to the integument. On cutting down over the tibia, there was found under the fascia a thin layer of coagulated blood,

but no sensible extravasation of the size, and no injection of the clot. On cutting deeper the periosteum was found to be separated from the bone for the length of six or seven inches, by solid fibrinous effusion or clot, of chocolate colour, and a line or two in thickness. On the periosteal and osteal surfaces of this clot, there was a slight extravasation of the size, but the clot itself was beautifully injected. Small injected vessels could be seen in the clot by the naked eye, and by the aid of a glass they were very manifest. When the periosteum, which was itself thickened and infiltrated with blood, was gently stripped from the clot, many threads were seen to pass from one to the other; they were evidently vessels, and some of them filled with size. On stripping the clot from the bone, some vessels were also seen filled with size, coming from the former and entering the latter; but the vascular connection of the clot and bone was much less than that of the periosteum and clot. The clot in question surrounded the tibia, with the exception of the ridge on the anterior and outer surface of the bone; on this ridge the periosteum adhered to the bone, but could be readily stripped from it. A few lines beyond the limit of the clot the periosteum was perfectly natural in appearance, and adhered to the bone with its usual firmness. The bone itself did not appear diseased.

There were other clots separating the periosteum from the bone, on the fibula of the same leg; one on the femur, some on the tibia of the opposite leg; and on the upper and lower jaws". He points out that although painful nodes on the tibiae and swelling of the lower jaw have been noticed by other writers on scurvy, the exact anatomical condition had never before been ascertained. In two of Dr. Budd's cases there was considerable exudation of transparent serum under the arachnoid, and the ventricles were distended with fluid, and in the brain itself he notes that beyond a general paleness of tissue, there was no characteristic change.

Finally, Dr. Buzzard, (40) in discussing the morbid anatomy of scurvy, refers to the "simple serous effusions, depending apparently on the obstructed circulation which occur especially about the feet and ankles". He says further that "the condition of the brain varies considerably. It is often free from any appearance of lesion. Sometimes there is effusion of serum under the arachnoid, and into the ventricles, whilst the vessels on the brain surface are empty, and the general aspect of its substance is pale. In other cases cerebral vessels are gorged with very dark fluid blood, or coagula; and there may be ecchymoses upon the surface of the brain, and sanguineous effusion into its substance. An equal uncertainty

attends the condition in which the heart may be found. It is sometimes pale and flaccid, with the cavities quite empty. In other cases it is filled with black liquid blood, and its cavities are dilated. The muscular substance of the heart may be ecchymosed". His summing up is interesting: "with all the variety which may present itself in the post mortem appearances there is one which is constant in all cases of death from scurvy. In some part or other, sanguineous effusion into the tissues will be discovered".

We now pass on to describe more minutely the post mortem appearances in fatal cases of scurvy occurring amongst children.

There is, as a rule, well marked pallor of the whole surface of the body indicating extreme anaemia during life. Scattered patches of haemorrhage are usually present in the skin, which may present the appearance of minute 'petechiae', or may be as large as a threepenny or shilling piece, or may form extensive blood swellings in the skin. These petechiae are not to be considered so characteristic of scurvy as the larger haemorrhages, for minute skin haemorrhages are extremely common ante mortem occurrences in many fatal diseases of childhood. The colour of the haemorrhages will, of course, vary with the period of their duration, and the alteration of the effused blood that has occurred during life. Oedema

of the extremities is commonly present. Emaciation may be present, but it is not to be regarded as due to the scorbutic disease per se.

The Bones and Periosteum. The long bones shew marked and characteristic alterations in scurvy. Haemorrhage takes place under the periosteum, commencing usually at one or other epiphysis, and gradually extending until the whole of the periosteum is stripped off the shaft. The result is that the shaft is cut off entirely from its periosteal connection, and lies in a layer of blood, and blood clot, for coagulation quickly takes place in the effused blood. This haemorrhage is not usually sudden and complete, but occurs at intervals as is manifested by the condition of the effused blood which may be red and fluid, or in clots, black or white, or more or less organised into fibrinous material. Further, haemorrhage commences usually at the epiphysis, which becomes disorganised and separated so that crepitus can be made out between the shaft and the epiphyses. The shaft is entirely separated from its connections, and more especially from its vascular supply, so that it lies quite loose, and undergoes a process of atrophy. When this stage is reached, the shaft of the bone will be found extremely friable, and in fact fractures are often

found post mortem, unaccompanied by any formation of callus. The medulla is filled with a soft red material, and as the bone wastes, the medullary cavity gets correspondingly enlarged. The epiphysis is soft, broken down, and infiltrated with blood, but is never so altered as its shaft and retains its connection with the periosteum. The periosteum, as has been stated, is commonly stripped off the shaft by the gradually increasing effusion of blood commencing at the epiphysis, but in other cases the haemorrhage seems to come from the periosteum itself, and may occur over any part of the shaft of the bone. The detached periosteum is often much thickened, and infiltrated with serum or blood, and shews great injection of vessels on its internal surface, while in other cases it presents no apparent alteration. The above changes are found most markedly in the femora, and tibiae, and are usually present on both sides although they may vary in degree, and to a less extent in the other long bones of the extremities. The neighbouring joints are quite unaffected. Similar changes occur in the ribs. The attachments to the sternal cartilages are loosened, so that the sternum often sinks inwards. The shaft of the rib becomes a mere shell with a large cavity containing a dirty haemorrhagic fluid. In extreme cases, these subperiosteal haemorrhages may occur also in the scapulae and ilia. When well marked

atrophy of the long bones is present, it points to repeated haemorrhage under the periosteum, probably of some duration, which has cut off the shaft from its blood supply. The microscopic examination, under those conditions, shews the periosteum thickened and vascular, but without cellular infiltration. There are no inflammatory changes in the bone, but considerable absorption of the trabecular structure (Barlow)

The Muscles of the extremities, and to a less degree of the body generally, are pale, atrophied, and fatty. Extravasations of serum or blood are often present between the muscles, or into their substance, and may be so extensive as to cause an increase in the bulk of the muscle, which to the touch feels soft and diffluent. In some cases there is an effusion of fibrinous material between the tendons, especially *beneath* the ham strings and tendo achillis, which becomes organised and leads to a fixed condition of the joints (false ankylosis). The knee may in consequence be rigidly flexed, and the foot may be in a condition of talipes equinus.

The Gums shew the changes so well known in connection with adult scurvy. The mucous membrane around the teeth is swollen, purplish, spongy, ulcerated, and may be fungoid. The teeth are loose and decayed.

The whole mouth is blood stained, the source of the bleeding being the swollen gums.

The Heart muscle is pale and flabby, and may contain blood or serum effused into its substance. In cases of death from cardiac syncope, the cavities are usually empty. Where death has occurred more slowly, it contains more or less dark blood, and there are usually present in addition white ante mortem clots extending into the larger blood vessels. These arise from the tendency the blood has during life to coagulate.

The Skull. Up to a certain point the lesions of the skull are similar to those of the long bones, but differences come in owing to the nature of the cranial contents, the brain and meninges. Haemorrhage under the pericranium is often present, and may be of considerable extent. The skull bones are often thickened, softened, and reddened. The trabecular structure becomes thinned out and breaks down easily.

The Brain and Meninges. Dr. Barlow (4) quotes a case of Möller's in which intra cranial haemorrhage was present. "A marasmic child, aged 15 months, was brought with exophthalmos and sanious discharge from the nostrils, and died from exhaustion. On post

mortem examination an extensive haematoma was found under the frontal and anterior parts of the parietals, extending down to the orbital plates of the frontal, and to the ethmoid and into the orbits. The blood was believed to be derived from the inner surface of the bones of the skull, in which no thickening was found, but the vascular canals of the inner surface of the frontal were considered to be wide and the bone itself somewhat porous". Owing to the absence of any affection of the limb bones, Dr. Barlow does not include this in his list of cases of "acute rickets". With the exception of the above case I have not met with any published account of an autopsy in which intracranial haemorrhage was present. My own experience is limited to two cases, and these will be found recorded at length in the appended list of illustrative cases. In the first case, there was the condition known as Haematoma of the Dura Mater. A thick purplish mass enveloped the whole of the brain, of varying thickness, and separable into layers. It was adherent to the Dura Mater, but could easily be stripped off, and the adjacent surface of the dura presented no pathological appearance. On microscopic examination, these false membranes seemed to be composed of blood, and blood clot in varying degrees of organization. The brain was extremely atrophied from pressure. In the second case, a large amount of blood was found

covering the vertex on both sides under the dura mater. The base of the brain was surrounded by a layer of yellowish membrane which was apparently organised blood clot. There were two subcortical haemorrhages in the posterior frontal region, one on each side. In both these cases it is to be noted that there was no sign of inflammation present, the sole changes present being due to the haemorrhage, the organization of blood clot; and the mechanical results of pressure from the effused blood.

Lungs and Pleura. A varying quantity of fluid, clear or blood stained, is often found in the pleural cavity in fatal cases of scurvy in children, and small haemorrhagic spots may be present in the pleural membrane. As regards the lungs, small infarcts, or more diffused haemorrhages infiltrating the lung substance are occasionally met with.

The intestines, the kidneys, the spleen, the liver, and the serous surfaces may also be the seat of haemorrhages.

Summing up these observations, we note that in all organs the lesion is a vascular one, and that the morbid appearances are due to haemorrhage, and the results of haemorrhage. There is no evidence of inflammation, and no tendency to the formation of pus.

The structures chiefly affected are those in which growth is most active during infancy and early childhood, viz. (i) the long bones (ii) the skull and brain, (iii) the teeth. In the long bones the active centres of growth are the epiphyses, and here it is that the haemorrhage usually commences. As regards the brain, Dr. Buzzard remarks that "considering the delicate structure of the brain, it is remarkable that lesions of this organ occur by no means so commonly as in other and less vital parts of the economy". In children and infants there is in addition an increased vascular supply to meet the requirements of the growing brain, and therefore haemorrhage is even more to be expected than in the case of adults. That its occurrence in scurvy has not been more frequently noted is due, I believe, to the fact that the primary disease has not been recognised, and that the haemorrhage has been regarded as sufficient proof of syphilis or some allied disease. The third centre of active growth in infancy, namely the teeth, are undoubtedly the seat of vascular disturbances, but these, and the cause of their total absence in certain cases, ~~will~~ have been referred to ~~later on~~.

(v. s. p. 19)

V. DIFFERENTIAL DIAGNOSIS.

1. From Rickets. This disease is so frequently associated with scurvy that the danger lies in our ascribing all the symptoms to the rickets and not recognising the scorbutic element. In the earlier stages of scurvy the diagnosis between the two is extremely difficult, but sooner or later the onset of swelling of the limbs, of sponginess of the gums, and of haemorrhage will point clearly to some superadded affection. In all cases of rickets, where tenderness of the limbs is present, with anaemia and increasing listlessness, and where no other cause for these symptoms such as syphilis, enlarged spleen, etc. can be found, we ought to remember the possibility of scurvy and see that a sufficient amount of antiscorbutic element is present in the food.

2. From Syphilis. The diagnosis here is often extremely difficult. Both Scurvy and Syphilis may be present at the same time in the same child, and even if the syphilitic disease is not active, it may so affect the scorbutic symptoms as to make them extremely puzzling. Anaemia, cachexia, and haemorrhages are common to both, but the greatest similarity lies in the symptoms connected with disease of the bones. In both we may have a swelling commencing

around the epiphysis which increases, and spreads along the limb, is extremely painful, and leads to loss of power and finally complete paralysis. In syphilis this is a form of epiphysitis, which quickly becomes suppurative, and the pus extends along the shaft, detaching the periosteum as it goes. The epiphysis may be separated from the bone and crepitus elicited. In scurvy, as we have seen, the effusion is haemorrhagic, and both inflammation and suppuration are absent. In distinguishing between these affections, it is to be noted that syphilitic bone disease occurs usually in infants under six months of age, while scurvy is rarely if ever present at that period. The brawny thickening due to extravasation into and between the muscles in scurvy is not found to occur in syphilis. In syphilis suppuration is usually limited to the neighbourhood of the epiphysis, and rarely spreads as far along the shaft as the haemorrhagic effusion does in scurvy. The temperature is usually higher in the disease associated with suppuration. In syphilis this epiphysial affection is rare, in scurvy it is common. In doubtful cases, an exploratory puncture through the periosteum may be made, when the presence of pus in one case, and of blood in the other, will clear up the diagnosis.

3. From Muscular Rheumatism. In children under

two years this difficulty is not likely to present itself, but after that age it sometimes occurs. A typical case has been published by Dr. Colcott Fox in the 41st. Vol. of the Pathological Society's Transactions, of which a summary is given at the end of this paper. The patient may complain of pains in the limbs on walking, tenderness on pressure over the muscles, and possibly may lose the power of standing or walking. The attack may last a short time, then pass off, and recur again during the following winter. Progressive wasting of bones and muscles is noticed, and rigidity of the knee and ankle joints may supervene, the knee being flexed and the foot pointed (pes equinus). Nodes may be present in the long bones due to localised subperiosteal haemorrhages. These conditions may lead to a diagnosis of rheumatism. In most cases, however, there will be present in addition some of the symptoms of scurvy which are not associated with rheumatism, such as spongy gums, haemorrhages under the skin or from the mucous membranes, oedema of the extremities, and cachexia. Enquiry into the diet will probably elicit the fact that the patient has been having little or no vegetable food. The absence of other rheumatic symptoms, such as progressive heart disease, (although a haemic murmur may be present due to the scorbutic anaemia) profuse sweating, swelling of the joints, tonsillitis etc.

will give additional aid in the diagnosis.

4. From Hip Joint Disease. This is mentioned because the diagnosis has sometimes been made in cases of scurvy. It can at once be excluded if a careful examination of the patient is made, for the hip joint is never affected in scurvy. The mistake is only likely to occur if the haemorrhagic effusion takes ^{at the upper epiphysis of the femur, and at no other spot,} place, an extremely rare condition.

5. From other varieties of the Haemorrhagic Diathesis. In most of these there are some leading symptoms or signs which enable us to arrive at a correct diagnosis.

(i) Leucocythaemia. Microscopic examination of the blood will reveal an excess of leucocytes which is never found in scurvy.

(ii) Lymphadenoma. The general and progressive enlargement of lymphatic glands and lymphoid tissue present in this disease does not occur in scurvy.

(iii) Splenic Enlargement. Hypertrophy of the spleen does not occur in scurvy, nor, I believe, in rickets. Still an apparent enlargement is often present, due to rachitic constriction of the chest pressing the spleen below the ribs so that it can be felt distinctly.

In such cases, percussion in an upward and

backward direction will reveal whether the spleen is really enlarged or not. In chronic splenic enlargement, while subcutaneous haemorrhage and oedema of the eyelids and extremities may be present, we do not find any sponginess of the gums, or subperiosteal haemorrhages, such as occur in scurvy. The therapeutic test will very quickly settle the question in doubtful cases, for if the disease is primarily splenic, no rapid effect can be produced by any food or medicine, while if it is scorbutic, the administration of potatoes and fruit will lead to a speedy cure.

(iv) Haemophilia. In this affection, a hereditary tendency is present, haemorrhages occur while the child is in good health otherwise, and a common condition is extravasation of blood into the knee or other joints. These points, and the absence of special scorbutic signs, will probably be sufficient to clear up the diagnosis.

(v) Purpura. The manifestations of this ~~affliction~~ affection are in many cases extremely similar to those of scurvy. In the diagnosis of the latter we depend on the history of imperfect diet, on the cachexia and extreme debility

of the patient, and finally on the result of the administration of antiscorbutic food.

(vi) Anaemia. In the symptomatic form of anaemia a careful examination will usually lead to the discovery of some general cause (tuberculosis, syphilis, rheumatism etc.) or some local affection (empyema, pleurisy, Bright's disease, etc.) sufficient to account for all the symptoms. In the idiopathic form of anaemia, the irregular pyrexial attacks, the diminution of the number of red corpuscles, the absolute pallor of the complexion as contrasted with the dirty yellow colour present in scurvy, and the absence of spongy gums or subperiosteal haemorrhage will mark out the disease.

VI. PROGNOSIS.

The prognosis in scurvy is extremely good, provided that the disease is not too advanced, and that suitable treatment is employed. The results in those cases are amongst the most rapid and striking to be met with in therapeutics. Some hold that the natural course of the disease is towards recovery, and point to the beneficial results which appear with the advent

spring sunshine and warmth, without the adoption of any treatment. While it may be admitted that certain cases shew a tendency to recovery apart from any treatment, even those patients usually suffer from a recurrence of the disease, if they continue to live under the same conditions, and each attack leaves them more impaired in health. Dr. Cheadle has never seen a case of infantile scurvy recover under the exclusive use of Swiss milk. Dr. Barlow has convinced himself, "that the disease in question often tends towards a slow, but ultimately complete recovery, and this independent of any special treatment."

During an attack of scurvy the chief danger to which the child is exposed is death from loss of blood, and more especially from the haemorrhage under the periosteum of the long bones which may be very extensive. In more prolonged cases, the progressive anaemia slowly wears out the vital powers. The liability to complications, such as pneumonia, is also to be observed, and an attack of this disease from which a healthy child might recover quickly, is usually fatal to a scorbutic patient.

VII. TREATMENT.

In discussing the question of treatment it must be kept in mind that those materials which, when sup-

plied to a child in health will be sufficient to ward off scurvy, are not on that account to be regarded as also sufficient to cure the disease when once it is fully developed. Prophylaxis is one thing, cure is another. In discussing the etiology, we have referred to the evidence that scurvy is caused directly by the absence of fresh food from the diet, and more especially by the absence of vegetables and fruits, and this leads us directly to the special treatment necessary to cure the disease.

In children under two years of age a diet of fresh cow's milk is to be ordered, suitably diluted with water or barley water according to the age of the child. I do not believe that much reliance is to be placed on meat juice or beef tea as an anti-scorbutic, but they are nevertheless useful in scurvy owing to the fermentative disorders so often associated with a purely milk diet. In the treatment of these, raw meat juice is extremely useful, and will tend to improve the patient's general health, although the special scorbutic manifestations may remain untouched. On the other hand all the forms of preserved milk are to be absolutely forbidden, along with the various infants' foods. Our purpose here is not to discuss the value of these preparations in the diet of healthy infants, but to point out that in scurvy they are distinctly injurious.

In the case of older children, the diet allowed is more extensive, and may consist of milk, eggs, fish, meat, etc., care being taken that the food is fresh, and not salted or preserved in any way.

The most important part of the diet consists in the free administration of fruits and vegetables. The full list of these is a very large one, but amongst children the following will be found the most useful, namely, oranges, lemons, grapes, potatoes, and cabbage. It is important that these should be fresh, for their antiscorbutic value is lowered by their being artificially preserved. It has been often noted how voraciously scorbutic patients will devour fruit and vegetables, and therefore care must be taken that the amount supplied is not in excess of the digestive powers, in which case diarrhoea etc. may follow, and interfere with the recovery. With this reservation, both fruits and vegetables are to be freely administered. The improvement which follows is rapid and striking; improvement is often noted within a couple of days, and recovery, as regards all acute manifestations, within a week. The time for a complete cure will of course depend on the duration of the disease, the amount of haemorrhage, and the general health of the patient. In some cases a positive aversion to fruits and vegetables has been present, but this dislike usually gives way to a little firm treatment, and the result is as

satisfactory as in other cases.

I have laid emphasis on the fact that the diet must be good and nourishing, and must contain a full amount of fresh vegetable material, because some have been content to rely on a small quantity of "lime juice" as a complete treatment, and have been disappointed with the results. Dr. Curnow (41) writing of his experiences at the Dreadnought Hospital, says, "Patients have been admitted who have regularly taken apparently good "lime juice" for a long period, but whose dietary in other respects was bad, so that lime juice must be considered as only the most valuable adjuvant in the prevention of scurvy, and not as an absolute and complete substitute for a proper anti-scorbutic diet." I have already referred to the opinion expressed by Budd that cooking lowers the antiscorbutic value of vegetables, and while this may be admitted, it is nevertheless found that boiled potatoes, or potato soup, made with meat stock, carrots, and turnips, give excellent results in children.

As regards medicines, the most of them are of no special use in scurvy, and some of them are distinctly injurious. I refer more particularly to mercury, which has been so frequently employed owing to the disease being mistaken for syphilis. As a

rule the acute symptoms will be increased under the administration of this drug, while the general debility and cachexia may rapidly progress to a fatal termination. If the case is at all doubtful, and if mercury is being employed, it ought to be as a diagnostic, and the treatment should only be so far prolonged as to give time to test if improvement take place under its use.

For the pains in the limbs, due to fibrinous effusion, Dr. Buzzard recommends Iodide of Potassium, which will hasten absorption.

In the convalescent stage, cod liver oil is of great service in restoring the general health, and iron is useful if anaemia is present.

The local treatment in scurvy is unimportant, because under proper diet, all manifestations clear up so rapidly. If the gums are ulcerated and bleeding, they may be painted with a solution of glycerine of tannic acid, and a mouth wash of sanitas lotion may be ordered. When the limbs are swollen and tender, support and rest by means of sand bags, and the application of cold compresses, will give relief.

Mr. Herbert W. Page (17) has operated in one case, that of an infant aged nine months. He cut down on the femur and tibia, found them to be entirely denuded of periosteum along the shafts, and turned out masses of blood clot which surrounded the bare

bone. The wounds showed no undue tendency to bleed. The child made a good recovery, but in addition to the operative treatment, suitable diet was employed. There is, however, no call for surgical interference in such cases, for under antiscorbutic diet, the haemorrhage ceases, and the effused blood is rapidly absorbed. A general painless thickening may persist for some time along the shaft of the bone, due to delayed absorption of the clotted blood, but this also will ultimately disappear.

The general hygienic treatment must be attended to. Sunlight and fresh air are of great value, and walking exercise is of more benefit than driving. It must be remembered, however, that fatal cardiac syncope sometimes occurs, and therefore rest in bed ought to be maintained until the patient is free from pain and breathlessness, and has been under antiscorbutic diet, as described above, for some time.

P A R T I I .

ILLUSTRATIVE CASES WITH COMMENTARY.

CASE I.

Female child aged 16 months: extreme tenderness of
lower limbs: swollen thighs: oedema of ankles:
spongy gums: skin haemorrhages: rapid recovery.

In May a female child, aged sixteen months, was brought to the hospital with the following history. She had been ailing for some months. A fortnight previously she began to cry when dressed or touched; and for the past week she had screamed violently whenever she was moved. Her sole desire seemed to be to lie perfectly still, and she would remain for hours quite apathetic, lying on her back with her legs drawn up. Two months ago her gums became swollen, and a week ago, as the swelling was increasing, the gums were lanced by a doctor. There had been no bleeding from the gums. The bowels were regular. Her appetite was poor. No history of melaena or haematuria was obtained.

She had always been a delicate child, but the chief illness had been bronchitis, to which she was very subject. Since three weeks old she had been fed on condensed milk, with occasionally a bit of bread. She had never had cow's milk, or fruit, or vegetables. The family history was good. There were five other children alive, and one child had died from measles.

On admission the same day (May 15th.) the child was found to be fairly well nourished but distinctly anaemic. She lay quietly in bed with both thighs drawn up on the abdomen, and the knees flexed. She resisted any movement, particularly of the legs, and cried out whenever she was touched. The thighs and legs were tense, and shiny in appearance, and both ankles were swollen, oedematous, and very tender to touch. There were well marked signs of rickets, thoracic rosary, widely open fontanelle, etc. Over the body and limbs were numerous small haemorrhagic spots, and a few were present on the face. The gums were very much swollen and spongy in front, but were not ulcerated or bleeding. There were no teeth visible, and the mother stated that none had appeared.

The temperature was 103⁰, and this was probably due to the bronchitis from which the patient was suffering. The heart was normal, and the liver and spleen were not enlarged.

The patient was ordered a diet of cow's milk, milk puddings, and oranges, with cod liver oil as medicine. Four days later (May 19th.) distinct improvement was noted. There had been some bleeding from the gums for the first day or two, but this had ceased. The gums were less swollen, less spongy, and less inflamed. The child was not so fretful, and the tenderness in the limbs had diminished. The oedema of the ankles was also considerably lessened. On

the 21st. the child could move the limbs without pain. On the 25th. she was discharged cured, the only trace of disease left being a certain amount of anaemia. The treatment had been the same all through, and it was noted that she seemed particularly to enjoy the oranges.

Remarks. This case follows closely what may be described as the typical course of scurvy in children, and for that reason I have given it. The cause lay in the insufficient diet, which consisted solely of condensed milk and bread; the signs and symptoms are those commonly associated with scurvy; and the rapid recovery under suitable diet, with oranges, may be described as characteristic of the disease, provided that it has not advanced too far, and that no serious complication is present.

CASE II.

Male infant aged 17 months: anaemia: thighs swollen and tender: subperiosteal haemorrhage: oedema of ankles: gums spongy: albuminuria: death: autopsy.

This child was brought to hospital on April 19th. suffering from swollen thighs and loss of power in the limbs. The child was born with a hare lip, and had never been able to take the breast, and had been

brought up on cow's milk. His health had been fairly good until two months previously, when he seemed to be more fret^{ful} and cried a good deal. About five weeks ago, the mother noticed that the child cried when his right leg was moved, and a week later she found the right ankle swollen. This swelling went down, and later the upper part of the right thigh, and the right knee became enlarged. The right thigh had continued to increase in size, and the child had lost flesh. There had been sweating at night about the head. Recently the child had been fed on cow's milk, beef tea, and eggs. There had been no other illness. As regards the family history, phthisis existed on the mother's side, and the father had suffered from hip joint disease. There were two other children, alive and healthy, and one child had died at eleven months of some wasting disease.

The child was anaemic and emaciated, and presented well marked signs of rickets. The heart and lungs were sound, and the liver and spleen were not enlarged. There was considerable swelling of the right thigh in its whole course; the skin was tense, with the superficial veins well marked; there was no fluctuation, but a general feeling of brawny hardness. The thigh was kept flexed and slightly everted. The thigh was extremely tender to touch, and the child screamed if it was moved. No separation of the epiphyses of the

right femur could be made out, but it was impossible to make a thorough examination owing to the extreme tenderness. The left thigh showed considerable brawny thickening, but there was no prominent swelling, no tenderness, no fluctuation, and no separation of the epiphyses. The tibiae were somewhat enlarged at their lower ends, but there was no thickening or tenderness around. There was slight oedema of the right foot and ankle. The gums were purple, swollen, spongy and bled when touched. Along the four lower central incisors, the gum was ulcerated and bleeding, while along the molar region, where the teeth had not erupted, there was a purplish swelling of the gum without any ulceration. There were no purpuric spots in the skin.

Progress. April 24th. Child remains dull and apathetic, and cries out if the limbs are moved. There is now a distinct swelling of the left thigh, extending three inches above the knee. It is hard and firm and tender to touch. On the 25th. a needle was introduced into the swelling of the right thigh, and a few drops of blood were removed, in a jelly like condition. The femur was felt to be bare. On the 30th. it was noted that the sponginess of the gums was less, but the patient was more anaemic. Oedema was present in both feet and ankles, and in the hands

He died on the following day.

The temperature during the first week was sub-normal, and never rose above 99.8°. The urine was acid, s.g. 1010, and contained a trace of albumen. The diet consisted of cow's milk, pounded meat, potato pulp, and lemon juice. Half a grain of grey powder was administered at night, and half a drachm of cod liver oil twice a day.

Autopsy. The body was anaemic, much wasted, and rachitic, (enlargement of epiphyses at wrists, and slightly at ankles, and very prominent costal rosary). There was no cranio tabes, or bossing of the skull.

The incisor teeth were cut but no others. They were loose and covered with sordes. The gums were soft, swollen, and purplish in colour. The swollen condition of the gums was universal, and was not confined to the site of the teeth already cut, although it was more pronounced in their neighbourhood. There were no petechiae or bruises about the body, and no external signs of congenital syphilis. There was considerable oedema of the right foot and leg, and of both hands on the dorsal aspect; and slight oedema was present in the left foot. The right thigh was enlarged to twice the size of the left. This swelling, which fluctuated freely, occupied the whole line of the shaft of the femur, ending at the upper and lower

epiphyses. Neither the knee joint, nor the hip joint was involved. On incision, about three ounces of thin dark blood escaped. The swelling was a large blood sac, the walls of which were formed by thickened and gelatinous periosteum. It contained (besides fluid blood) a large handful of black clot, with colourless masses of fibrin, the latter forming an incomplete lining to the thickened periosteum. The cavity ended abruptly at the junction of the periosteum with the upper and lower epiphyses of the femur. In the centre, surrounded by blood clot, was the roughened and bare shaft of the bone. The lower epiphysis was separated from the shaft, but was held in position by the thickened periosteum. The inside of the shaft was soft, pulpy, dark coloured and haemorrhagic. In the left thigh a similar condition was present, but far less extensive than on the right. The lower epiphysis was detached, and the periosteum was thickened and gelatinous, and separated from the shaft in the lower half by extravasated blood and blood clot. The periosteum was adherent to the upper half of the shaft, but could be stripped off more easily than usual.

The other long bones were examined, and incisions made at the epiphyses of the tibiae, but no abnormality was discovered.

The lungs were pale and oedematous. A few petechiae were present in the pleura covering the right upper lobe. The brain was not examined. The other

organs were normal.

Remarks. The haemorrhage in this case was very extensive and was probably the cause of death. The history of the child's diet is unfortunately incomplete, but it was not specially inquired into, and the mother, as is usual in those cases, simply gave the diet at the time the child was ill, and not the ordinary diet. I have little hesitation in affirming that this child had not been having a sufficient quantity of fresh cow's milk.

In the upper part of the left femur it was noted that the periosteum stripped off more easily than usual, even although it was not detached by extravasated blood. This condition of the periosteum is often present in the bones in scurvy, before actual haemorrhage has taken place.

CASE III.

Boy aged four years: Epistaxis: purpuric spots: skin ulceration: haemorrhage into scalp: death from cardiac syncope: autopsy.

This patient was said to have been perfectly well until six days before he was brought to hospital. His

mother had then noticed a blister forming on his right forefinger, and another on the left middle finger. These had increased in size, had broken, and had left ugly sores for which she brought him to the hospital. He had suffered from epistaxis during the previous five days. She had seen some spots on his body, but thought they were flea-bites.

There was no history of a haemorrhagic diathesis in the family, or of other disease.

The patient had never been very strong, but had never had any severe illness. His food had been chiefly bread and butter, and tea. Milk he would not take, and he had occasionally meat, potatoes, fish, and eggs.

There was an open sloughing sore on the dorsal, and partly on the palmar aspect of the right forefinger, and a similar one on the left middle finger. The skin at the root of the diseased fingers, and along the dorsum of the hands was quite dark in colour and gangrenous looking. The ulceration had involved the whole thickness of the true skin, and extended into the deeper structures.

The child was markedly anaemic, and lay in a curious apathetic condition. He moaned a good deal as the fingers were being dressed. There was no sign of swelling, or ulceration about the gums. The nostrils were filled with dried blood. On examination

of the body, numerous small haemorrhages on the trunk, and the extremities were seen, some evidently recent, and others more or less faded in colour. The largest, about the size of half a crown, was situated along the inner border of the right axilla.

As the child was manifestly suffering from some general disease, his mother was advised to leave him in the hospital. This she declined to do without first consulting her friends, and went into the waiting room for that purpose. In about ten minutes she came running back, saying the child had a fit. He was breathing stertorously, and very slowly; the pupils were equal and reacted to light; the heart sounds could not be heard, nor the pulse felt at the wrist. Stimulants were applied, but after a few more breaths, the patient expired.

An autopsy was made 52 hours after death. The body was well nourished, but markedly anaemic. He had evidently suffered from rickets. There were traces of blood in the nostrils, and sordes about the lips, but no ulceration or sponginess of the gums. There were numerous purpuric spots over the trunk and limbs, one large haemorrhage at the edge of the right axilla and another above the left clavicle.

Chest. A drachm of clear fluid was present in the pericardium. The heart tissue seemed normal:

the left ventricle was in a condition of almost complete diastole, and both ventricles were empty. There was no ante mortem clotting. The pleural cavities were empty. Both lungs were congested, but otherwise normal. At the root of the lungs, the bronchial glands were enlarged, indurated, and dotted with tubercular nodules.

Abdomen. The abdominal walls were well lined with fat. There was some enlargement of the mesenteric glands. The stomach contained about an ounce and a half of partially digested food. The gastric mucous membrane was normal. The intestines were almost empty. The lining membrane was anaemic, and Peyer's patches were prominent, but there was no evidence of any irritation. The spleen and kidneys were normal, and the bladder was firmly contracted over about one ounce of normal urine.

Cranium. On removing the scalp, a haemorrhage of recent origin was seen, about the size of a two shilling piece, situated two inches above the left ear, and occupying the whole thickness of the scalp. The skin over this was uninjured. The skull cap and the dura mater were thick. The brain was anaemic and soft, but presented no evidence of disease.

Remarks. Although death from cardiac syncope is a not uncommon occurrence amongst adults suffering from scurvy, this is the only case I have seen amongst

children, and I have not been able to find any published cases. The question therefore arises, was the above a case of scurvy? The evidences in favour of scurvy on which I would lay stress are, (i) The sloughing ulcers on the fingers, (ii) The epistaxis, (iii) The diet of tea, bread, and butter, (iv) The profound cachexia with anaemia, (v) The haemorrhages into the skin and scalp, (vi) The absence of any other disease, as far as could be recognised during life, or on post mortem examination. I do not think there can be any doubt that the boy died of cardiac syncope, and this of itself is of extremely rare occurrence in children unless they are suffering from some acute disease. This patient had had no acute illness, and although it was manifest at once that he was extremely ill, his mother had not noticed anything wrong except the sores on the fingers, for which she sought treatment. This gradual onset is quite in accordance with what we know of adult scurvy. Thus Dr. Hilton Fagge (43) writes, "Usually, but not always, the more definite symptoms of the disease are preceded by a general failure of health and strength. The face becomes pale and sallow, with a livid discolouration of the lips and cheeks. So characteristic is the patient's appearance, that the cause may often be known at a glance. The spirits are depressed and gloomy, the mind apathetic and indifferent, while

great lassitude, a sense of fatigue, and shortness of breath are felt after exertion." This well describes the boy's condition when he was brought to the hospital.

This tendency to a fatal cardiac syncope is well known on the case of scorbutic patients. Thus Dr. Lind (39) says "They are apt, upon being moved, or exposed to the fresh air, suddenly to expire." Dr. Budd (42) states "We have already spoken of the debility, and the tendency to swoon, in persons affected with scurvy. In high degrees of scurvy this tendency is so great that the slightest motion, the erect posture even, occasions fainting which sometimes proves fatal." Dr. Buzzard (40) writes "The breathlessness is very frequently accompanied by occasional faintings, especially when the body is made to quit the horizontal posture. These attacks of syncope are highly perilous. It has happened to us on more than one occasion to witness death from this cause. The patient, previously recumbent, has suddenly sat up in bed to receive our visit, and speedily fallen back in a fainting fit, from which he could not be restored." Dr. Hilton Fagge also refers to this tendency. He says (43) "The muscular weakness is frequently so great that the patient faints if he attempts to sit up in bed. Indeed this is sometimes the cause of a fatal termination at a comparatively early stage of

the disease which otherwise seldom destroys life, even in bad cases, until after a lapse of some weeks."

From these quotations, it is but natural to conclude that similar tendencies to syncope would be present in children suffering from scurvy. Dr. Barlow has referred to such syncopal attacks, and other references will be found in some of the following cases. It is but a step further to fatal cardiac syncope, such as was, I believe, the cause of death in the case under examination.

CASE IV.

Male child aged 12 months: spongy gums; oedema of eyelids; conjunctival haemorrhage; haematuria; purpuric eruption; death from catarrhal pneumonia; and membranous laryngitis; autopsy.

This patient was admitted to hospital in January with the following history. Four months previously, when he began teething, a swelling of the gums was noticed, first over the lower jaw, and then over the upper jaw, and the mucous membrane broke down and bled. Two months ago a swelling of the right upper eyelid was noticed, unaccompanied by any other oedema. At his first teething, and since then at different periods, he had eruptions of red spots over the body,

and limbs, which broke out suddenly, and gradually faded away, becoming violet and yellow as they passed off. The urine had often been pink in colour, never red. The bowels are rather confined; the motions are dark in colour but no blood has been passed. At times he has been sick but has never vomited blood.

His health has been good up to the present illness. The diet consisted of Neave's food, Liebig's Extract of meat, and Nursery milk. The home surroundings have been comfortable, the rooms bright, and free from damp. The father and mother are healthy. There is one other child alive, aged five years, who suffered from sores on the body when teething, but is otherwise healthy. Two children were born dead, and there has been one miscarriage. With the exception of the above, no history pointing to syphilis could be elicited, and there was no rheumatism or phthisis in the family.

On admission the patient was a fairly well nourished child, but very anaemic. There was a puffiness about the face generally, and great oedema of both upper eyelids, which were red in colour. The eyelids were so swollen that they could only be opened to a very slight extent. Oedema was present in the skin over the feet, legs, and hands. A haemorrhagic eruption of small spots existed over the upper half of the left forearm, anteriorly and posteriorly, and

over the lower half of the right leg, and a few scattered petechiae were present on the dorsum of the right foot. These spots could be felt distinctly in the skin. Below the right knee were some broad patches of ecchymosis, of a light greenish colour.

The right conjunctiva was paler than normal. The conjunctiva of the left eye was very much swollen, and congested, of an almost black colour in parts, and dark red in others. The gums above and below anteriorly were very much swollen, and ulcerated, especially in the upper jaw. The upper and lower incisor teeth were said to have been cut, but were entirely obscured by the swelling. The gums were sloughing in parts, grey or black in colour, and the parts around were deeply congested. The odour of the breath was very offensive. The temperature was 102°. Bronchitic sounds were present in the chest, which was distinctly rachitic. The heart sounds were good. The liver and spleen were not enlarged. The urine was acid, of a pink red colour, and contained a good deal of blood. Microscopically it shewed red blood cells, and a few blood casts.

In a few days the gums were much better, and the oedema of the eyes was considerably reduced. The patient took cow's milk voraciously. There were no fresh spots. Microscopic examination of the blood shewed nothing abnormal. The bronchitis had improved

and the temperature was steadily falling.

On the 1st. February, signs of catarrhal pneumonia were present. These increased rapidly, and there was considerable laryngeal stridor present. The temperature rose rapidly, and he died on the 4th. of February.

Autopsy. The body was somewhat emaciated. A few faded purpuric spots were present over the flexor aspect of the left forearm. The central and lateral incisors of the upper jaw, and the lower central incisors, were the only teeth which had erupted. About these teeth the mucous membrane was soft, spongy, and ulcerated, the teeth being quite loose. The mucous membrane of the alveolar edges behind the teeth, and the remainder of the mucous membrane of the mouth, was healthy. Lining the upper part of the larynx was a thin white membrane, which peeled off without much difficulty, and left a markedly congested surface beneath. There was marked oedema of the aryteno-epiglottidean folds. The trachea below was normal. Catarrhal pneumonia was present in both lungs; the areas of consolidation were limited, and the bronchi contained non-purulent viscid mucous. The heart seemed normal. The liver was enlarged and fatty. The brain, and meninges, and other organs were normal.

Remarks. This case was proceeding satisfactorily

until the occurrence of an attack of broncho-pneumonia, which proved rapidly fatal. This is a common complication of scurvy, and is usually fatal, owing to the weakened state of the patient. There was no evidence of subperiosteal haemorrhage in this case, although from the age of the patient one would have expected it, and Dr. Barlow has laid great stress on that symptom in the case of children under two years of age. In the above case the haemorrhage was more extensive than usual, affecting the gums, the conjunctiv~~ae~~^{ae}, the skin, and the kidneys. The condition of the eyes and eyelids calls for special note, and corresponds with what is known to occur in cases of adult scurvy. Thus Dr. Buzzard writes (40), "In some cases the eye and its surroundings are the only parts exhibiting signs of scurvy. The appearance presented is then very remarkable. The integument around one or both orbits is puffed up into a bruise like swelling. The conjunctiva covering the sclerotic is tumid, and of a brilliant red colour throughout, about the eighth of an inch in thickness or elevation above the cornea, leaving the cornea at the bottom of a circular trench or well. We have seen many cases in which this appearance together with pallor of the complexion, and listlessness, constituted the only evidences of scurvy, and they have generally been of the most serious character, often terminating fatally". This condition

is well illustrated in the above case, and from the remarks quoted, it will be seen that this variety of haemorrhage may form a most important diagnostic point.

CASE V.

Female child aged 5 years. Pains in the limbs;
inability to stand or walk; anaemia; ulcers on vulva;
albuminuria; oedema; subperiosteal haemorrhage;
death from pneumonia; autopsy.

This patient was seen for the first time in October. She had been ill for one month, and ^{had} lost the power of standing or walking. She complained of pain in the limbs generally, and was extremely tender to touch. The throat was painful, and the tonsils were found to be inflamed and swollen. A systolic murmur was present at the cardiac apex. I diagnosed the case as one of rheumatism, with muscular symptoms, and ordered a mixture containing salicylate of soda. She was treated at home for a month for acute rheumatism, and then as she seemed to be getting worse, the doctor sent her to the hospital.

The child's previous health had been good. For six months preceding her illness her diet had consisted

of bread and butter, condensed milk, tea, and occasionally a little meat. All her life she had had a positive aversion to fruit or vegetables of any kind. There was a family history of phthisis, and the mother had had several miscarriages.

On admission she was found to be fairly well nourished, but anaemic, with a dull expression of face. She had a marked disinclination to move, or even to speak, and cried when any of her limbs were touched. The dorsal decubitus was maintained with the knees and elbows flexed. There was no oedema present. The gums were healthy: there was a slight watery discharge from the nostrils, and some enlargement of the cervical glands. A few ulcers, with dirty sloughing surface, were present on the labia majora. The temperature was 101.6°. On examination of the lungs, the right upper lobe was found to be quite dull, and the breathing over it was tubular, with numerous râles, and bronchophony was present. The first sound of the heart was muffled, but no murmur was detected.

Two days later (Nov. 23rd.) the temperature had fallen to normal, the pulse was 120 per minute, and the respiration 28. The extreme tenderness in the limbs continued, so that no thorough examination could be made. The urine was alkaline, sp: gr: 1028, and contained a trace of albumin. On the 28th. the temperature had risen to 103.4°, and there was evidence

of fresh pneumonic consolidation in the right lung. The most marked tenderness was present in the left leg, and thickening could be made out along the course of the left tibia. On the 30th. the temperature had risen to 105.4°. The urine contained one-sixth albumin. Oedema was present in both feet, but was most marked in the left. She died on the following day.

Autopsy. There was considerable oedema of the left leg and foot, of the right arm, and over the chest walls. The gums and fauces were healthy, but there were sordes on the lips. Over the labia majora were some shallow superficial ulcers.

Lungs. Abundant soft yellow lymph covered the right pleura, with numerous recent adhesions. The right lung was almost completely solid, the upper two-thirds being in a state of grey hepatization, and the lower third in a condition of red hepatization. The left lung was congested. The mitral valve was thickened, puckered, and insufficient, and the chordae tendinae were shortened. *A firm ante-mortem clot was present in the right ventricle, and extended to the pulmonary artery.*

Bones. On cutting down on the left tibia, the periosteum was found detached throughout the whole diaphysis, and the bone was white and necrosed in appearance. A layer of semi-solid blood clot lay between the periosteum and the bone over the lower third. On dividing the tibia at the upper part and

using slight traction, it came away leaving the lower epiphysis behind. The line of junction was rugged and blood stained, but there was no pus present. The ankle joint was healthy. The right radius was examined, but shewed no pathological change.

The dura mater, the brain, and the abdominal organs appeared healthy. Suppuration was present in the middle ear on the right side.

Remarks. This is another illustration of the liability of scorbutic patients to pneumonia, which is usually fatal. On the patient's first visit, I made the mistake, - "the time honoured mistake", Dr. Colcott Fox calls it - of regarding the symptoms as due to rheumatism, but the subsequent history clearly shewed that the disease was scurvy from the beginning. The complete absence of any affection of the gums, and the marked periosteal affection in a child of five years is opposed to Dr. Barlow's theory that in children over two years the bone symptoms recede into the background and the swelling of the gums becomes the characteristic lesion. Speaking generally I think the statement is correct, but from this and other cases I am of opinion that no absolute law can be laid down which will distinguish the scurvy of infancy from that of childhood. The ulceration present in the vulva is in accordance with a similar tendency to ulcer formation which is known to occur in adult cases.

Dr. Cheadle describes ulceration in the wrist and fingers in one of his cases, and another example of the same condition has been described in Case III.

Dr. Barlow has noted in several of his cases a marked disinclination to vegetables, or meat, or both, and there is no doubt that this is an important factor in producing the disease. This patient had a positive aversion to fruit or vegetables of any kind, and her mother stated that she would never touch a pudding if there were any raisins or currants in it.

As a matter of experience, however, there is not much difficulty in overcoming this dislike under hospital treatment, and it is probably fostered and encouraged at home owing to parental weakness. The extensive ante-mortem clot in the heart is, I think, to be regarded as more than a coincidence, and as the result of the morbid condition of the blood, which in this disease has a special tendency to coagulate, or produce fibrinous effusions. Out of ~~the~~ three post mortem examinations made by Dr. Budd in cases of adult scurvy, he found extensive fibrinous coagula in the heart in two cases.

CASE. VI.

Female child, aged two years; anaemia; fracture of humerus and femur; periosteal effusion; bruise like extravasations; death; autopsy; haemorrhage into the brain and its membranes.

This patient was admitted to hospital on March 21st. The child had been healthy when born. and was fed on the breast entirely for four months. Since that time her food had consisted almost entirely of Nestle's milk.. There had been no snuffles or rash observed. Four months ago she was put out to nurse. The nurse stated that in the beginning of February the child seemed to have great pain in the right thigh which was swollen, and she took her to a hospital where disease of the hip joint was diagnosed, Two days before admission the mother got the child back, and noticed a swelling along the right thigh and also along the left upper arm. There was also a bruise like discolouration over the right side of the forehead.

The patient was an only child. The father and mother were healthy, and there had been no miscarriages.

On admission the child was found to be fairly well nourished, and had a pale waxy complexion. There were some dirty looking sores along the upper lip, and

alae nasi, and also on the buttocks. A large bruise like mark was present on the right frontal eminence, greenish in colour. The signs of rickets were well marked. The anterior fontanelle was open, tense, and pulsating. The ribs were beaded, the epiphyses of the long bones were enlarged, and the bones of the forearm were curved with the convexity posterior. On the left upper arm a smooth, firm, tender swelling occupied rather more than the middle third. There was no angularity. The swelling felt like periosteal thickening. The right thigh was bent at an angle a little above the centre, and the femur was fractured. The upper fragment was directed forwards and the lower backwards. The lower part of the shaft was much thickened in its whole extent. No crepitus was elicited between the fragments, but there was extreme tenderness over the whole thigh, and the child cried with a shrill, piercing scream, when the limb was touched or moved. The temperature was 96°, and the pulse 100° per minute, small and weak. There was nothing abnormal in the heart, lungs, or abdomen.

On March 23rd. (two days after admission) signs of cerebral affection were present. The child was sick after food, or medicine. Pulsation had ceased in the fontanelle, and the pulse was weaker. There was rigidity of the neck. The pupils were dilated, and the head and eyes were directed strongly to the left

side. The left side of the face was drawn up. Both arms were rigidly flexed, and the hands ^{were} supinated; there was a good deal of tremulous movement in the arms at times. The child sank gradually, and died the same day.

Autopsy. The body was fairly well nourished. A subcutaneous haemorrhage was present over the right frontal region, and another over the front of the right thigh. The skull was markedly rachitic. On opening the dura mater there was found a large amount of blood, dark and fluid, covering the vertex on both sides, from the middle of the frontal to the posterior part of the parietal regions. The surface of the brain was covered with a layer of blood clot, and the cortex was deeply stained. The blood also extended between the hemispheres. The structures at the base of the brain were covered by a thick yellowish membrane, which was very tough, and contained no nodules or tubercles. It extended about half way up on each side, and passed into the Sylvian fissures.

The brain contained two haemorrhagic cavities under the cortex, situated in the posterior frontal region, one on each side. That on the right side ^{was the size} of a small Tangerine orange, and contained grumous, sanious fluid. The cavity on the left side was smaller and more irregular, and was partly filled with a small quantity of

yellow, turbid fluid. Under the microscope, this fluid was seen to consist of blood cells, mixed with a considerable number of fattily degenerated corpuscles. The lateral ventricles contained from two to three ounces of clear fluid. The extravasation under the dura mater seemed to be of some standing, from the considerable amount of organisation present in the membrane covering the base of the brain. The arteries at the base of the brain seemed thickened. On microscopic examination, the basilar artery was found to be occupied by a thrombus which had undergone some degree of organization.

The right femur was broken across almost transversely immediately above the centre. There was no attempt at union of the fragments, which were considerably separated. A large amount of soft material was lying round the shaft, under the periosteum, for the most part unorganized, but with a cartilaginous feel in parts. A similar condition was present in the left humerus, there being no appearance of union between the fragments, and a large quantity of soft material surrounded the broken ends of the shaft. The liver was tough, rather wrinkled and small. The other organs presented no abnormal appearances.

Remarks. The evidence in favour of scurvy in this case is, I think, fairly conclusive. The history of the diet was in accordance with such a result, and

the fact that the child was out at nurse makes it improbable that any food besides that mentioned would be supplied. The patient lived such a short time after coming under medical examination, and was so acutely ill, that no thorough observations could be made. Still the following points were elicited; (1) extreme anaemia (2) subcutaneous haemorrhages (3) subperiosteal effusion, with fractures of two long bones, and extreme tenderness of the limbs affected, (4) haemorrhage into the brain and its membranes (5) the absence of signs of other disease than scurvy, (except rickets), either during life or on post-mortem examination.

The fractures of the humerus and femur are interesting. There was no history of their having been due to violence, and the condition of the bones in scurvy is such that fractures take place easily owing to the brittleness of the shaft, and its separation from the periosteum. In rickets, fractures are also common, but are, as a rule, of the partial or greenstick variety, whereas in scurvy they are usually transverse.

The haemorrhage into the brain and membranes will be discussed in connection with the next case. This was undoubtedly the cause of death.

CASE VII.

Female child aged 14 months; rickets; oedema of eyelids; anaemia; cachexia; haemorrhages in skin; scalp, conjunctiva; ulceration round teeth; tenderness and oedema of extremities; syncopal attacks; death; autopsy; haematoma of dura mater.

This patient was seen for the first time on November 11th. when she was ten months old. She had had a fit five days previously, which had left her with convergent strabismus. Abdominal pain seemed to be present. The nose and hands were blue, and the mother stated that the child was subject to cold extremities. She was wasted, and seemed to have been neglected. The skull was large and there was distinct bossing in the frontal and parietal regions. The anterior fontanelle was widely open, and the sutures had not closed. The heart was normal, and a good deal of bronchitis existed in the lungs. The abdomen was prominent, and both liver and spleen were enlarged. There was no history of haematuria. The patient was suffering from "snuffles", but there was no other evidence of syphilis, nor could any history of it be obtained. Her diet at the time consisted of cow's milk.

As regards the family history, both parents were

healthy. There had been twelve children in the family, of whom only three survived, the others having died young, one from jaundice, and the rest from bronchitis. There had been no miscarriages.

The patient had always been subject to bronchitis. She never had fits with the exception of the one mentioned. In the end of the following January, the child was seen again. Both upper eyelids were oedematous. She was suffering from another attack of bronchitis, and looked ill. She was admitted to hospital on the 10th. February.

On admission, the patient was moderately well nourished, but markedly anaemic, with a yellow translucent skin. Over the right parietal bone, and part of the occipital, was a soft fluctuating swelling, considered haematomatous. The head was large, and natiform, with distinct bosses. The anterior fontanelle was open and the wrists were rather thickened. There were two subcutaneous haemorrhages over the spine, about the size of a shilling piece, and another on the inner surface of the right arm. There was no oedema of the extremities. The right arm was kept rigid, and the thumb was firmly adducted; there was also some tendency to adduction of the left thumb. The tongue was furred, and dry, and there was some ulceration round the teeth. The liver extended one inch, and the spleen one and a half inches, below the

costal margin. The heart was normal, and there was a good deal of bronchitis in the lungs. The patient was unable to swallow, and had to be fed with the stomach tube. The temperature was 100°, and the pulse 120, rather weak. The urine contained a trace of albumin, but no blood.

On February 12th. she had a syncopal attack: the extremities became blue, the pulse could not be felt, and the pupils were contracted. She recovered under stimulation.

On February 15th. she seemed to be improving. Her colour was not so yellow. She was still very apathetic, although not unconscious, and cried out whenever she was moved. As a rule she lay perfectly still, moaning at times as if in pain. The thighs were drawn up, and adducted.

On March 7th. an eruption of haemorrhagic spots appeared on the abdomen, and the back, for the most part small in size. This was accompanied by a rise in temperature, which had been normal for some days, to 101.40, and by diarrhoea, the motions being green and offensive.

There was another syncopal attack on March 9th. On the 13th. there were numerous fresh petechial spots over the trunk. The hands and feet were swollen, and the lower limbs seemed very tender to touch. There was a marked increase in the diarrhoea, which had been

more or less present during the previous week.

She died on the 26th. March. The child had been lying in a state of torpor since the last note. At times there was a condition of general tonic spasm of the muscles, the eyes being turned to the right, The extremities were blue and oedematous, and the cardiac action was very feeble. The abdomen was extremely retracted. The temperature had been gradually falling, with occasional pyrexial attacks, and for two days before her death it was 95°. No treatment had any effect. The diet consisted of fresh cow's milk, milk puddings, lime juice, and brandy, and medicinally she had grey powder, mercurial inunction, and cod liver oil.

Autopsy. The body was extremely emaciated, with a complete absence of subcutaneous fat. A subconjunctival haemorrhage was present in the inner and upper surface of the right eye. The teeth and gums were covered with sordes. On the mucous membrane of the lower lip opposite the central incisors was an ulcer, deeply excavated, with hard raised edges, and a yellowish base.

The skin was wrinkled and parchment like. The anterior surface of the body, from the nipple line to the umbilicus was densely spotted with purple, ante-mortem petechiae, mostly the size of a pin's head.

There were a few ante-mortem bruise like marks about the extremities, of larger size than those on the trunk, notably one on the outer side of the right leg, and two symmetrically placed on the back of each forearm, the size of a three-penny piece.

There was considerable anasarca of both feet and ankles, and clear fluid escaped on puncturing these regions. A more solid oedema occupied the backs of both hands. There were no ulcers or excoriations about the arms or buttocks.

The skull was typically natiform. The parietal and frontal eminences were very protuberant, and the fontanelle was open and depressed. There were bilateral grooves in the long axis of the thorax at the side of junction of ribs and cartilage. No 'beading' was felt externally, but on opening the thorax, the cartilaginous extremities of the ribs were seen to be enlarged. The epiphyses of the long bones were also somewhat enlarged. Incisions made over the tibiae showed the bones to be normal. There were no periosteal thickenings, and no subperiosteal haemorrhages. There was no epiphysitis anywhere in a more advanced condition than that mentioned above.

There was some collapse in both lungs, and pleuritic adhesions were present on the right side. The liver was small, mottled on cut section, and there seemed to be some increase of Glisson's capsule along



Case VII. View of the vertex of the skull, with the false membranes attached.

On the right upper corner the layers of membrane are detached, and separated by pieces of cotton wool, which are seen as white patches in the photograph.

the portal vessels. The spleen, kidneys, and intestine appeared normal.

On dissecting off the scalp, a ragged red appearance was noted on the inner surface covering the right parietal bone. A large haematoma had been situated here three weeks before death. The parietal and frontal eminences, and also the squamous portions of the temporal bones, were much thickened, of a deep red colour, and soft enough to be indented easily by the finger nail.

Considerable difficulty was experienced in removing the skull cap, not only owing to the usual adherence of the dura mater to the cranium, but also to the following condition. Beneath the dura mater there was in the situation of the subdural space, a dense, fleshy, purplish red, smooth and soft deposit, which completely covered the surface of the brain. It was generally loosely adherent to the under surface of the dura mater, and could be easily peeled off, except in the neighbourhood of the sinuses, where it was more firmly attached. The dura mater above it was white and glistening. The deposit varied from one sixteenth to nearly three quarters of an inch in thickness, the thickest parts being towards the base of the skull, in the anterior and posterior fossae. Beneath this layer, and easily separable from it, was a second dense white membrane, and on the under sur-

face of this was a third layer of soft, yellowish, coagulated lymph, somewhat closely adherent to it, and to the brain surface, (or pia mater beneath). On removing this third covering, the brain was exposed, and presented the following unusual appearances. It was generally atrophied, and weighed fifteen ounces. The convolutions were ill-defined, and narrow, and the sulci were obscured, particularly the fissures of Sylvius and Rolando, by a layer of yellowish solid lymph, encircling the contracted and anaemic blood vessels, and causing the pia mater to bulge externally.

The convolutions generally were of a pale greyish colour. In striking contrast to these were certain limited convolutions which were of an entirely different aspect. The latter were of a dirty orange yellow colour, considerably depressed below the general surface of the convolutions, feeling so hard and dry to the touch that they were thought at first to be the seat of old caseating gummata.. However, on section it seemed that only the pia mater, and the extreme outer surface of the grey matter were thus affected. The pia mater was thickened and gritty, and perhaps the yellow appearance was due to a fatty degeneration of old inflammatory deposits.

The various cranial nerves were white and glistening, and to all appearance normal. There were no thrombosis of the sinuses, and no disease of the petrous,

or any other bone. On section, the brain was found to be tough, but otherwise normal.

On opening the spinal canal, there was a deposit of soft material like red currant jelly beneath the dura mater, and covering the cord, particularly well marked in the posterior dorsal region. It seemed justifiable to regard this as an effusion of blood stained lymph, and as perhaps resembling the early stage of the much more advanced effusion in the cranial subdural space.

Microscopic examination. The false membranes around the brain presented the appearance of blood clot in different stages of organization. In some parts they consisted of fibrinous tissue containing unchanged blood cells, in others organization was more advanced, and strands of connective tissue were found, forming spaces which contained groups of altered blood cells.

In the liver there was a slight increase in the amount of connective tissue surrounding the portal vessels, but the hepatic cells were unaltered.

Remarks. In this case we have a combination of diseases. The signs of rickets and scurvy are, I think, unmistakeable, and there is also a certain amount of evidence in favour of syphilis. The distinct bossing of the skull is by some regarded as

distinctive of syphilis, while by others, among whom is to be included Dr. Barlow, it is accounted a manifestation of rickets. The question has not been definitely settled, and it is not of special importance in this case, for while the possibility of syphilis being present may be admitted, the whole series of symptoms, and the pathological changes found at the post mortem^{examination,} were not such as are present in syphilitic disease, but were quite in accordance with a diagnosis of rickets, and scurvy. Further, mercurial treatment had been employed without benefit, both while she was attending as an outpatient, and after her admission to hospital.

Remarks on Cases VI. and VII. In both of these, a leading feature was the condition known as Pachymeningitis Interna Haemorrhagica, or Haematoma of the Dura Mater. This was extremely well marked in the latter case, and was present to a slighter extent in the former.

The best account of this affection is given by Huguenin in Ziemssen's Cyclopaedia of the Practice of Medicine (Vol. XII). Huguenin says, "Pachymeningitis occurs in scurvy; here, however, we have no personal observations to offer. Many cases exist where syphilis was supposed to be the original disease; the connection is not clear; certainly no one will be disposed to

refer the affection to Heubner's disease of the cerebral vessels".

In Dr. Immerman's article on Scurvy in Ziemssen's Cyclopaedia (Vol. XVII), which is extremely full and comprehensive, the occurrence of intracranial haemorrhage is regarded as very exceptional amongst adults. He says, "As very rare local affections of scurvy are to be considered the isolated cases of intermeningeal haemorrhage, which usually run their course under the form of rapidly fatal apoplexy, but also in some cases led to death with the appearances of gradually augmenting compression of the brain: headache, dullness, and finally stupor. It is still doubtful whether or not haemorrhages occur in the substance of the brain". He does not record any case with post mortem examination.

Huguenin refers to Virchow's theory that Pachymeningitis is a haemorrhagic inflammation of the dura mater, but is of opinion that inflammation is never present, and that the whole process consists of extravasation of blood, at first from the dura mater, and subsequently from already existing pseudo-membranes.+ As regards the pia mater, he has frequently

+ Dr. Wigglesworth also supports the non-inflammatory view. Vide brain. Parts LIX and LX, 1892. "Remarks on the Pathology of so-called Pachymeningitis Interna Haemorrhagica".

seen "the changes attributed to recurring fluxionary hyperaemia (formation of small fibrous callosities, or at times a thick dense leathery membrane, in connection with atrophy of the brain)". He has also observed, "a yellow colouration of the arachnoid, of the subarachnoid fluid, and even of the surface of the brain, penetrating to a greater or less depth". Amongst all the cases that Huguenin was able to collect, he found that 2.7 per cent occurred in children under twelve months, and 2.7 per cent in children from one to ten years of age.

These appearances recorded by Huguenin are very similar to the ones I have described in the two cases under consideration. About the nature of the meningeal changes there can be no doubt; the only question is as to the primary disease, for haematoma of the dura mater is always a secondary affection. In the history of the cases I have adduced the evidence on which I base the diagnosis of scurvy. In haematoma of the dura mater, we find:

- (1) A tendency to recurrent attacks of haemorrhage without local inflammation.
- (2) That coagulation and organization of the extravasated blood occur, and,
- (3) That the effects are entirely those of mechanical pressure.

These conditions have been already described as characteristic of the subperiosteal, and other haemorrhages of scurvy.

In case VI., there was no evidence during life as to the period of onset of the meningeal affection, but the organised membrane at the base of the brain pointed to an attack some time previously. In case VII., the occurrence of a fit at the age of ten months, accompanied by strabismus, points to the first extravasation of blood from the dura mater. Accepting this as our guide, we find that the patient lived four months after the commencement of the Pachymeningitis.

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Appendix of Published Cases
in Brief

I have made a short abstract of thirty published cases, which exemplify the points on which I have laid stress in discussing the subject of scurvy in children.

Another list of thirty one cases, collected by Dr. Barlow, will be found in the 66th volume of the Medical-Chirurgical Society's Transactions. None of these are included in the following table.

| Name of Observer | Age. Sex. Month | Previous Diet | Extremities | Gums. Teeth. | General Condition. Skin. Temperature | Other Symptoms. | Progress. |
|---|----------------------|--|---|---|--|---|---|
| Case I. Dr. Cheadle Janet 2/78 (Case 2.) | 16 m. F. March | Quart of cow's milk per diem until 10 m. old. Then bread. Red clover food. Would not eat potatoes. | Legs swollen and oedematous. Swelling around shafts of long bones Hard swellings in deep muscles of thighs. General tenderness | Gums, spongy, swollen, protruding between lips. | Skin muddy | Sore on wrists and fingers Rickets present Albuminuria | Rapid recovery under diet of cow's milk, mashed potatoes, raw meat juice & oranges. Mile in skin marks |
| Case II. do. do. (Case 3) | 3 y. F. March. | Suckled two years. Then bread & butter, tea, German sausages, brandy & water. | Oedema of ankles. Tenderness in both arms. Muscles flabby. No deep seated swellings detected. | Gums fungous, swollen, bleeding. Breath offensive | Skin muddy | Rickets well marked no albuminuria. | Rapid improvement under same treatment Cured in five weeks. |
| Case III. Dr. Cheadle "Artificial Feeding" p. 223. | 14 m. M. January | Bread and water for three months. | No periosteal or muscular swellings. | Gums swollen, spongy, livid. | Oedema. Debility, Emaciation Scattered skin haemorrhages. | Rickets slightly marked Sloughing sores on R. hip. Oedema of scrotum. no albuminuria | Diet as above. Death in 4 days. P.M. Extensive haemorrhage into lungs; most of tissue solid from clotted blood. Numerous small haemorrhages under serous membranes of thoracic organs. |
| Case IV do. do. p. 224 | 13 m. April | From 6 weeks to 11 months farinaceous and disea- lated food. Then milk 1/2 pint with oatmeal milk thought to be adulterated. | Tenderness and swelling of the legs immediately below the knees. Tender all over to touch. Skin tense and shiny over swollen limbs. | Gums swollen, purple, spongy. | Petechiae over leg. | No albuminuria. | Diet as above. In 4 days very great improvement. Cured at the end of 3 weeks. |
| Case V. do. do. p. 226 | 1 y. January | after 3 m. maltd farinaceous food and condensed milk | Limbs tender, bruised on handling. Distinct swelling on front of each tibia. | Gums dark- coloured & spongy | Pallid: cachectic: drowsy: listless Very breathless on exertion | Oedema of feet. Slight rickets Diarrhoea. Melæna once or twice Haematuria and albumin- uria. | Diet as above. Cured in one month. |
| Case VI. do. do. p. 229 | 9 m. April. | Entirely farinaceous and desiccated foods. | Great tenderness of limbs on movement. legs drawn up. Periosteum over tibia swollen. | Gums swollen, dark, No teeth present. | Plump. Fair colour. | Distinct rickets. No albuminuria. | Diet as above. A violent fit of crying produced copious extravasation of blood beneath both lower eyelids. Rapid cure. |
| Case VII. Dr. J. Thomson. (16) | 7 m. M. February. | Condensed milk from birth. Infant's food. | Dislikes being pulled about. No tenderness or swelling locally. | Gums pale, not swollen. No teeth present. Lower incisors cut | Sanguid, thin pale. Yellow, earthy complexion | Slight rickets. Haematuria and albumin- uria. | Diet as above. Rapid cure. |
| Case VIII Dr. G. G. (10) | 11 m. F. June | Condensed milk and Mellin's Malt- Extract. | — | Gums healthy. | — | Haematuria of six weeks duration. Blood constantly present in urine No tube casts. | Cow's milk. Two drops of Tr. of Black Hellebore three daily. Haematuria ceased en- tirely in less than a week. |
| Case IX. Dr. G. G. (10) | 10 m. F March. | Nestlé's food. Robinson's goats Some cow's milk | — | Gums healthy One lower incisor tooth cut. | — | Rickets present Haematuria of six weeks duration. | Antiscorbutic diet Haematuria soon ceased Infant took lemon juice with avidity |
| Case X. Dr. J. B. Ball (23) | 14 m. F. June | Nestlé's food, with a little condensed milk for past 5 m. Previous to that, breast milk, cow's milk, and con- densed milk. | Loss of movement, and tenderness in the lower limbs. Swelling of left tibia and right femur. No crepitus, or sign of separation of epiphysis. Feet and ankles swollen. | Four teeth present surrounded by livid, swollen, spongy and bleeding gums. Dusky red swelling over the site of future molars. | Pale. Emaciated Apathetic, and crying on movement. | Slight rickets | Rapid recovery under cow's milk, meat juice, and orange juice |

| Name of Observer | Age. Sex Month | Previous Diet | Extremities | Gums. Teeth | General Condition Skin. Temperature | Other Symptoms | Progress |
|---|----------------------|---|---|---|--|---|---|
| Case <u>XI.</u> Dr. Charpentier (15) | M. 9m. | Condensed milk Pabst food. | Thighs tender to touch. Left thigh swollen, hard, and brawny | Gums red and swollen. No teeth | Fat, flabby, pale. Bruise on back Ecchymosis pyelitis | Cried when moved. Rickets present. | Rapid improvement under antiscorbutic diet |
| Case <u>XII.</u> Mr. Godlee (11) | 11 m. F. June | Condensed and cows milk. Sago. Bisquick | Extreme tenderness in lower limbs. Swelling. Separation of the upper and lower epiphyses of the long bones of the legs. Some oedema of left leg, with purplish discolouration | No swelling or sponginess of the gums. | Pale, anaemic, listless. No pur- puric spots on the skin | Well marked rickets. Diarrhoea | Rapid recovery under cows milk and the juice of lemons |
| Case <u>XIII.</u> Mr. Owen. (12) | 21 m. F. March | From nine months condensed milk, Ridg's food, wheat meal, bread and butter. | Right leg and thigh swollen: the skin tense and oedematous. On puncture of the thigh, the serum was found quite pure, and a few drops of blood escaped. | Gums were swollen, spongy, discoloured, with capillary haemorrhages, and bled at the slightest touch. | Anaemic, with lead-like aspect. No marked elevation of the temperature | Rickets present. He lay helplessly on his back, moaning in- cessantly. | Recovery in six weeks under anti- scorbutic diet |
| Case <u>XIV.</u> Dr. G. R. Lake (14) | 12 m. M. February | Breast up to 3 months then Nestlé's milk food. | Loss of power in legs and pain on movement. Legs swollen on lower two thirds of tibiae. Skin tense and shiny. | Gums swollen, spongy, bleeding. | Anaemic Skin haemorrhages on sternum. | Marked rickets. | Rapid recovery under antiscorbutic diet. |
| Case <u>XV.</u> Dr. Barlow (By Clap. Dis. of Child.) (5) | 10 y F July | Bottle fed. Later bread and butter. Aversion to meat, milk, and vegetables. | Unable to stand, and cried when the lower limbs were moved. Drop thickening of lower third of right thigh, apparently periosteal. Great tenderness. No oedema | Gums spongy Breath offensive Teeth loose. | Pale. Dirty, sallow complexion. General list- lessness | Had similar attacks on four previous summers. Tendency to syncope at at- tacks. Rickets present (deformities) | Recovery in six weeks under anti- scorbutic diet |
| Case <u>XVI.</u> Dr. Barlow (do.) | 4 y. F. | Washed nursed at 14 months then bread, bacon, pudding, gravy, cold tea, milk. Great dislike to vegetables. | Unable to stand. Great tender- ness when lower limbs flexed or extended. No oedema or swelling | Sponginess of gums. | Ecchymosis on forehead. | | Great improvement in one week under antiscorbutic diet. |
| Case <u>XVII.</u> Dr. Barlow (do.) | 2 1/4 y. F. May | Intolerance of milk Diet of biscuit powder, veal jelly, Reuzin's food, white of egg. | Lower limbs powerless. Extremely tender. No swelling. Sternum and costal cartilages sunk away from the ribs. | Sudden develop- ment of spongy gums, with great swelling. | Excessively pallid, No ecchymoses. | No signs of rickets | Complete recovery in six weeks under antiscorbutic diet. |
| Case <u>XVIII.</u> Dr. Colecott Fox. (19) | 11 m. M. April | Cow's milk, lufftea: eggs: Mellin's, and Ridg's foods. | Oedema of feet, legs, and thighs Extreme tenderness. | Gums spongy and livid. No foetus of teeth. | Extreme pallor, eyelids puffy and discoloured | Epistaxis. Albuminuria. Haemorrhagic bulla on foot. Rickets present. | Patient died in three days. P.M. Right humerus fractured through middle third: epiphysis separated by blood clot: periosteum along the shaft detached by blood clot. Haemorrhage around other long bones |
| Case <u>XIX.</u> Dr. Northrup. (27) | 16 m. F. | Breast until 4 months then proprietary foods Very small quantity of cow's milk | Right thigh swollen and tender. | Gums swollen, ulcerated, bleeding Points of the teeth protruding | Worried expression No cachexia No haemorrhages | No evidence of rickets | Rapid recovery under diet of cow's milk, baked potatoes, and oranges. Abrah of iron with excess of citric acid also given |

| Name of Observer | Age. Sex. Month. | Previous Diet. | Extremities. | Gums. Teeth. | General Condition Skin. Temperature | Other Symptoms. | Progress |
|---|---------------------|---|---|---|--|---|---|
| Case XX. D. Northrup. (27) | 18 m. F. | Suckled along with another child until 16 m. Considered starved by the doctor | Right leg and knee swollen and tender. Later, the left thigh also swollen. | Gums swollen, smoky black, and bled freely. | During last fortnight of life became anaemic with metallic pallor. | Both eyelids swollen, and black. | Death from Pneumonia after 7 days illness. P.M. Both thighs swollen from haemorrhage under periosteum. Detached epiphysis in both femora and both tibiae. |
| Case XXI. D. Northrup. (27) | 12 m. F. | 'Nurse child'. Condensed milk, and 'what was going'. | Thighs tense and tender. Blood drawn off by hypodermic needle. Femur bare. | Gums slightly softened. | Periosteal spots on body. T. 100°. | Recent history of vomiting blood, and passing blood per rectum. Rickets moderate. | Recovery. |
| Case XXII. D. Whitcomb. (28) | 11 m. F. May. | First 5 m. breast and artificial food. After that artificial food only | legs partially flexed, and rigid; muscular pains; great tenderness on movement. Hamstrings, and tendo achillis were hyperaesthetic, and seemed shortened as if by tonic spasm of the muscles. | Gums spongy and bleeding. | Anaemic. a few purpuric spots. | no evidence of rickets. | Rapid recovery under antiscorbutic diet. |
| Case XXIII. D. W. E. Green (25) | 12 m. July. | Ridgic's food. Sweetened, condensed milk. | Limbs swollen. Nodules on tibiae Pain on movement. | Two upper and two lower incisors cut. Gums swollen, sloughing, and bleeding copiously. Breath offensive | Pale and flabby. Nearly white sclerotics. Purpuric spots. Bullae on scalp. Face puffy. | | Treatment by raw meat juice, chlorate of potash, mercurial inunction, and later cow's milk, had no effect. Finally rapid recovery on giving a wine glassful of grape juice daily |
| Case XXIV. D. W. E. Green. (25) | 13 m. May. | Cornflour mixed with milk | Unable to move without pain. Legs drawn up on abdomen. Several hard painful swellings of a dull red colour on the legs and thighs | Had cut 7 teeth. Gums swollen, ulcerated, and covering the teeth entirely. Breath foetid | 8 km dusky. Erythema about the lips. Temp. 100.1 | At ten months the gums had been swollen, red, and bleeding. | Rapid recovery under cow's milk and grape juice |
| Case XXV. D. Julian Evans. (26) | 5 y. M. Winter | Bread and milk. Aversion to meat, vegetables, broth, or any soup. | Pains in legs. Cries out on movement. Cannot stand. Pain specially referred to thighs, and there is a periosteal swelling over lower part of both femora. | Gums swollen and bleeding. Breath foul. | Purpuric spots. | Blood in the mucus at anus. Two haematomata in scalp. History of two similar attacks. | He improved under diet of cow's milk, fresh lemon juice, and cream. Spontaneous cure. |
| Case XXVI. D. Rehn (29) | 15 m. | — | Both tibiae swollen. Oedema of feet and legs. Swelling round lower part of both femora, and both foramina | Blood stained swelling round upper 4 incisors and 4 molars. | Great anaemia. Temp. 38-40 C. | Rickets moderate | An exploratory incision down to shaft of tibia showed the periosteum completely detached by blood clot. The periosteum was thickened, infiltrated with serum, and blood stained on the inner surface. The upper epiphysis was loosened and infiltrated with blood |
| Case XXVII. D. T. Colecott for (20) | 13 y. M. March. | Out of bread and butter and gravy. No vegetables, or meat, or milk | Great wasting of bones and soft tissues of lower extremities. Knees and thighs flexed and rigid. Limbs tender. | Gums spongy and swollen. Breath foetid. | Dull and languid. Cachectic. No skin haemorrhages or oedema. | no evidence of rickets. History of many previous attacks. | Death. P.M. Form ant-mortem clot in right auricle. Subperiosteal haemorrhages in tibiae, fibulae, femora, humeri, radii, + cranium |

| Name of Observer | Age, Sex, & Season of Year | Previous Diet | Extremities | Teeth and Gums & Fingers | General Condition Skin. Temperature | Other Symptoms | Progress |
|---|----------------------------|---|---|--|--|--|--|
| Case XXVIII. Dr. Holmes Spicer (18) | 9 m. F. May. | Condensed milk. Dilute cow's milk Allen and Haurburg's food. | Lower limbs curved and slightly flexed. Great tenderness of joints and legs. Epiphyses enlarged | Gums not spongy. No teeth | Child fretful and very ill. Constant wailing. Skin mottled, blue and pink. | Slight epistaxis left eye displaced forwards and downwards by sub- periosteal haemorrhage. Conjunctival vessels in- jected. Upper eyelid swollen, tense, crimson later the Right eye was similarly affected. Rickets present. | Subsequent history not known. |
| Case XXIX Dr. Holmes Spicer (18) | 8 m. F. March. | Nestle's food Allen Haurburg's food. Cows milk sweetener. | — | Gums healthy. | Peevish and ill. | Slight epistaxis. Rickets present. Left upper eyelid swollen and retracted, eyeball pushed downwards and forwards. No retinal haemorrhage | Rapid improvement under antiscorbutic diet. Seven months later there was still slight but manifest fullness of the left eye |
| Case XXX Dr. Jones Bahman (24) | 6 y. M. July | Bread, butter & tea. Bacon. Meat occasionally. Did not care for potatoes. No fruit or vegetables. | Upper arms swollen, the skin tense, and bruise like extravasations present. Similar condition in the legs. | Gums red, spongy, and bled easily. Breath foetid. | Extreme languor and apathy. Few petechiae over trunk. | Eyelids red, swollen, and oedematous. Two motions streaked with blood. Ricketsy changes present. No albuminuria. | Ulcerative stomatitis was very severe, and later caecum oris developed. Ultimate recovery. |